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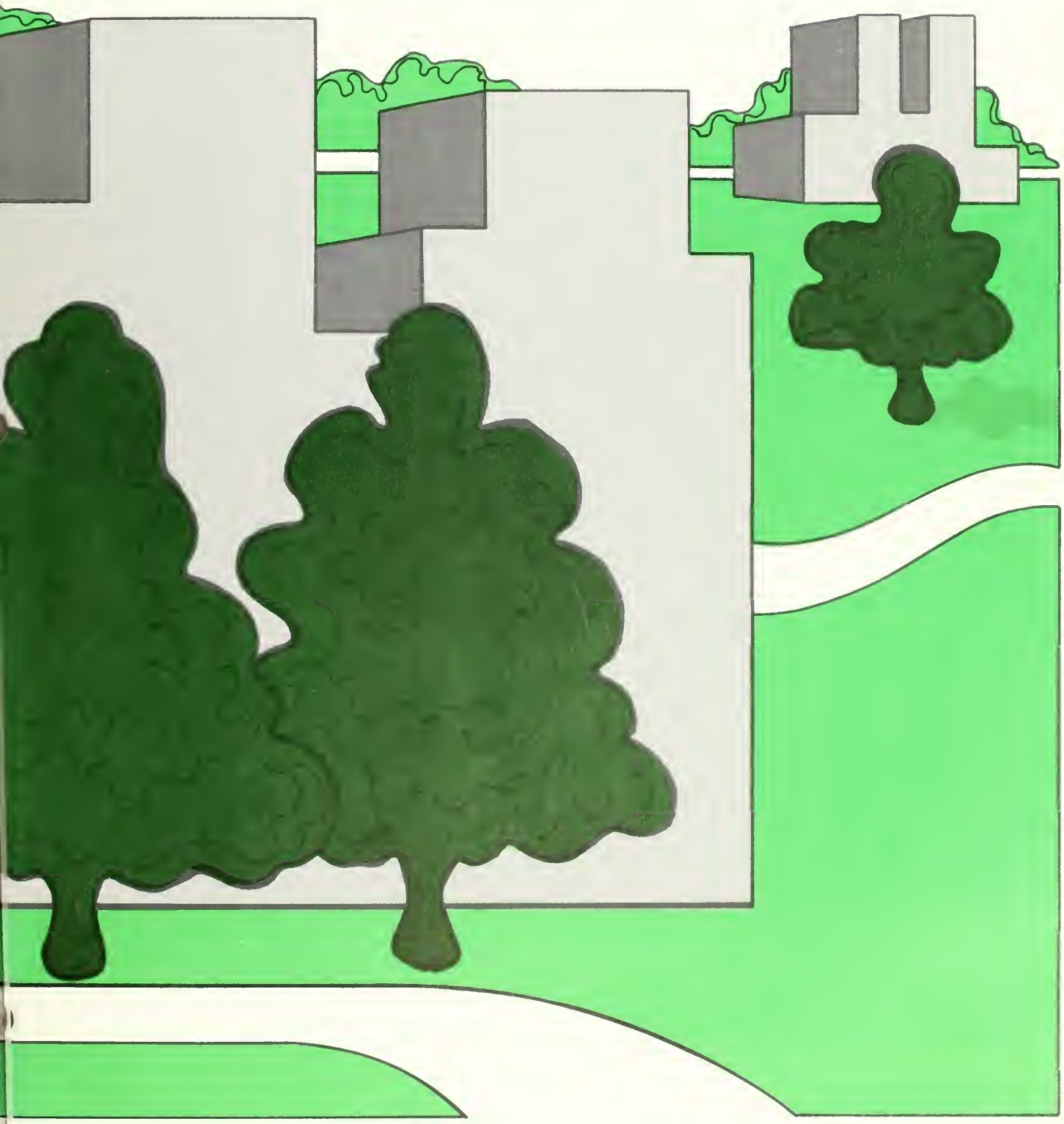

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Introduction

by Kathleen A. Pleasant

Urban forestry is a relatively new term for a concept that has been around for quite a while. For years, city governments have maintained professional foresters on its staffs to care for the city's trees. However, growing concern for the environment has prompted more and more of these foresters to be employed in urban areas.

Approximately 76% of Americans live in or near urban areas and it is safe to assume that this figure will rise in the years to come. As the sale of condominiums continues, as we purchase smaller homes and townhouses that require less energy but also offer less land, or no land at all, for recreational purposes, we instinctively turn to our urban forests for that occasional respite, for the reflection and solace we sometimes desperately need in our often crowded and often hectic lives.

Urban forests offer opportunities to recreate away from the everyday traffic and rushhour madness of highly congested areas. They offer city-raised children a wide variety of autumn foliage to delight over and collect, paths to follow and glimpses of wildlife in their natural habitat. Urban forests provide educational opportunities for both children and adults to learn about nature and the environment. They provide energy-saving opportunities and generate income through the sale of fallen or harvested trees to the public for firewood. And urban forests shelter our homes from strong winds, cool them markedly on blistering summer days, and significantly increase the property values of these homes.

This issue of Trends in Urban Forestry brings you interesting insights on urban forestry by professionals in some of the many organizations that are involved in this field. Employees of the USDA Forest Service; National Park Service; Urban Wildlife Research Center; Pennsylvania's Department of Environmental Resources; The University of California at Berkeley's Industrial Engineering and Operations Research Department; the Maryland Forest Service; the American Forestry Association; Fremont, Nebraska's Park and Recreation Department; and the Bureau of Forestry, Parkway and Beautification in Chicago, Illinois, share with you their research projects, programs, and thoughts. They also invite you to join them at a National Urban Forestry Conference scheduled for October 1982. Many of these organizations have joined together to coordinate and share information that provides more efficient urban forest management programs.

Urban forestry touches upon each and every person who lives or works in an urban environment. It is a field that offers opportunities for better understanding and cooperation between organizations and private citizens, opportunities to cooperatively produce and maintain a healthful, aesthetically-pleasing environment for all.

The urban forest is subject to many diverse pressures that threaten its very existence.

Paul Chelsey Smithsonian

Research Programs in Urban Forestry

by George H. Moeller

The Forest Service and Urban Forestry

Since 1905, the United States Department of Agriculture's Forest Service has been manager of the nation's forests and wilderness resources—187 million acres in national forests and grasslands. Except where excluded by law, these lands are managed for multiple products such as recreation, wildlife, range, timber, and water. The Forest Service cooperates with State forestry organizations to organize technical and financial assistance programs that improve forest management on 1.4 billion acres of private and non-Federal public forest and rangelands throughout the country.

The Forest Service operates a research program through a nationwide system of eight Forest and Range Experiment Stations and a Forest Products Laboratory. Over 150 units conduct mission-specific research to learn more about how to manage and use the nation's public and private forests and wildlands to more effectively meet a wide variety of demands. The goal of one part of this research program is to develop knowledge which will ensure better management of urban forest resources, and to maximize the benefits that this resource can contribute to the well-being of urban man.

Before describing the scope of this Urban Forestry Research Program, we should discuss what we mean by the urban forest. What are foresters doing in cities? And how did they ever get there?

The Urban Forest

Tree cover has always been an important part of the urban environment. We only now recognize the many values that these urban tree resources can produce, and we are more aware of the growing need to manage urban trees and associated vegetation—the URBAN FOREST—as a system to produce desired benefits.

Where is this urban forest? It occurs everywhere in and near cities. It is owned by many different kinds of people and institutions, both government and business. Like the rural forest, but perhaps even more so, the urban forest is subject to many diverse pressures —pressures that threaten its very existence!

The urban forest occurs as an interconnected vegetative system throughout most cities. It occurs in lines along streets and sidewalks, power lines, pipelines, utility rights-of-way, transportation corridors, as trees in small groups occupying vacant lots of preserves, and in backyards. Segments of the urban forest often link larger areas of forest cover in parks, preserves, arboretums, municipal watersheds, cemeteries, and undeveloped land typically found throughout urban areas.

How large is this resource? Studies show that 50 percent of the land area in the average American city is open—not covered by structures or hardened surfaces—and is capable of supporting vegetation. How much actual forest cover is there? Estimates vary, but when viewed from above, a conservative estimate is that 30 percent of the surface area of an average U.S. city is covered with trees. This is a larger portion of forest cover than is found in the typical countryside! It has been estimated that cities spend $300 million annually on maintaining urban forest resources, valued at $25 billion.

Because it is so diverse, the job of managing the urban forest is exceedingly complex. Among the factors adding to this complexity are: the high value of urban vegetation and urban land; the relative scarcity of forest and open space resource in relation to other urban demands; heavy use pressures; stress imposed by a man-dominated environment; unrelenting pressures for urbanization; and high public visibility and often diverging interests about appropriate land use. Because of these factors, the person responsible for managing the urban forest resource has a job that is probably more complex than the manager of more remote forest resources.

Forest Managers

Who is responsible for managing the urban forest? Many different professions, government agencies, and individuals have roles to play in managing urban forests. "Urban forestry" is not a precisely defined profession but a conceptual framework through which many specialists can direct their talents toward a common goal: to plan, manage, and protect urban forest resources in order to produce the largest quantity and highest quality of desirable benefits. There are many agents that influence the urban forest system. Private companies have been in the business of planting and caring for urban trees for many years. Utility companies, while providing needed utility services, attempt to manage urban vegetation to

USDA Forest Service

Urban residents benefit from urban forestry research.

better the environment. Add large corporate landowners, managers of public forests and open space resources and, perhaps most important, individual property owners with their backyard "forests," and we begin to get an idea of the diverse groups that influence the urban forests.

Many different kinds of professionals, trained in the tools of their profession, contribute to planning and management of the urban forest resource. For example: the landscape architect is concerned with enhancing natural beauty; the regional or urban planner integrates planning for urban forest values with comprehensive urban development; the horticulturist is concerned with the physiological processes that occur between a plant and its environment; the arborist, the wildlife manager, the forester, the recreationist, and many other professionally trained people are concerned with manipulation of those components of the urban forest that produce benefits associated with their profession. Each profession contributes its specialized talents toward fostering better management of the entire urban forest resource system.

The urban forest, then, is the part of the urban-suburban area made up of forest and associated vegetation, water, soil, wildlife, and related openspace resources. Management of this resource is the process through which multiple, long-term benefits are produced for the benefit of urban society.

Managing the Urban Forest

Urban forest management, and research to support management, involves four components: (1) defining and evaluating benefits; (2) determining and enhancing processes through which urban forests produce benefits; (3) developing better systems to physically manage and protect urban forest resources; and, finally, (4) integrating sound urban forest planning and management with the urban development process. Activities within each of these components are as follows:

- Defining and Evaluating Benefits:

  There are many benefits in which all people share from properly managed urban forests. There are also some

USDA Forest Service

Urban children learn how trees grow and how they can be used.

negative effects from urban forests such as clogged sewers, broken sidewalks, acts of vandalism, and destructive effects of wildlife. One of the goals of urban forest management is to maximize the positive benefits, while minimizing the negative effects.

Some benefits that can be attributed to trees and forests in cities can actually be measured in dollars and cents. For example: (1) trees provide economic benefits—they can increase housing values by as much as 20 percent; and (2) when used as windbreaks and for shade around homes, trees can reduce fuel used for indoor space air conditioning by 10 to 20 percent.

Other benefits can be measured but not in dollars and cents. For example: (1) a four-foot wide band of trees can reduce noise by 25 percent; (2) urban forests can improve air quality by intercepting 27 to 38 percent of particulate material and removing 9 to 13 percent of gas-like suspended particles from the air; and (3) a typical 40-acre city park can provide over a million visitor hours of recreation per year—more recreational use than provided by the average rural forest recreation area many times larger.

Other real benefits cannot be measured easily. For example, what is the value of a pleasant urban landscape that is enhanced by diversity and presence of ornamental trees? What about the value of moderated climate—cool shade and reduced wind—due to the presence of trees? How about a quieter, more tranquil environment? What is a diverse population of songbirds and other wild creatures that grace the urban landscape worth? And, what is it worth to an entire urban community to have a higher quality environment, a place where people can experience and benefit from nature first hand, while never leaving the urban setting? And what are these things likely to be worth as energy becomes more costly and more scarce?

Even if they cannot be measured, few would argue that benefits from well-managed urban forest resources are not worth the public investment in their management. But much research is needed to identify and quantify the variety of benefits from urban forests so that management for urban forest values can compete successfully in the tough urban marketplace.

- Managing and Protecting the Urban Forest Resource:

  The process of managing and protecting the urban forest system is as basic to producing a desired benefit, such as enhanced air quality, as the proper functioning of an automobile is basic to reaching a desired desti-

nation. Management and research activities important to the health and operation of the urban forest systems include: selection and development of trees that will tolerate stress imposed by the urban environment; production of nursery stock; and development of ways to plant, grow, protect, maintain, and manage urban trees.

But even when we know how to measure benefits, manage for desired benefits, and protect urban forest resources, we still need to know how to incorporate this information into the overall urban development process—a process that is in many ways hostile to the operation of a natural vegetative system.

- Processes through which Urban Forests Produce Benefits:

  Resource managers produce benefits by manipulating biological and physical components of the urban forest system. Once we understand how these components interrelate to produce a particular effect, such as noise reduction, the urban forest can be planned and managed to produce the desired result. Urban forest managers have always known that urban trees enhance urban environments, but it is only recently that research has begun to develop methods to increase the quantity and range of benefits through improved management practices.

- Integrating Urban Forest and Urban Development Planning:

  In the urban setting, the needs of man dominate the way to insure maximum benefits are obtained from urban forests. We need to devise ways to effectively mesh urban forestry planning and management with the comprehensive urban development process. This requires not only a thorough knowledge of urban forest benefit-producing capabilities and the values involved, but a system for information exchange and ways to assure public participation in all aspects of urban forestry planning and management.

Forest Service Research in Urban Forestry

Coupled with adequate program funding, a key to ensuring a high level flow of benefits from urban forest resources is to develop new management and planning systems and technology through research.

Urban forestry research in the Forest Service is done through Research Work units located at six locations throughout the country. Each unit consists of scientists and support staff who conduct research within an assigned unit mission. Although there is some research overlap because of geographic differences in relation to a specific problem, each unit mission is different. All urban forestry research is done within the bounds of a National Research and Development Charter. The charter outlines a 10-year program of research needs for all aspects of urban forestry. The goal of this program is to find better ways to manage urban forests which will enhance long run production of the widest possible array of benefits. To date, only one-quarter of the research needs outlined in the charter are being studied. The remainder will be addressed as funds and personnel permit.

Research is done by unit scientists, university cooperators, and cooperating public agencies. A brief overview of research activities of the six urban forestry research units follows.

First, Berkeley, California. This unit operates in urban areas of the Pacific Coast and Southwest. It identifies forest trees and related woody vegetation that is adaptable to urban areas in the region and helps design urban land use systems to maintain and protect urban forests. An important aspect of this unit's work is developing methods to involve urban residents in urban forest planning and management activities.

In the heavily urbanized Northeast, the Forest Service has three urban forestry research units at Amherst, Massachusetts; State College, Pennsylvania; and Syracuse, New York. At Amherst, scientists are studying urban landscapes and the recreation, wildlife, economic, and environmental benefits from urban forests. This effort seeks to improve the urban environment of the Northeast through better understanding of the social amenities that urban forests can produce. Research at State College is directed toward developing forest management guidelines for improving the metropolitan environment along the Atlantic seaboard from Boston to Washington, DC. Their research deals with developing management systems to reduce noise, moderate climate, reduce home energy consumption, and improve air, soil, and water production from urban forests.

In short, they are concerned with the physical environment as it affects and is affected by urban forests. At Syracuse, scientists are looking for ways to plan and manage urban forests by developing a better understanding of the relationships between urban land use and the ecology of urban vegetative systems.

In the Southeast, the unit at Athens, Georgia, emphasizes research to identify and measure urban forest benefits. Another objective is to increase the benefits from urban forests through careful selection and use of tree species best adapted to urban environments found in this part of the country.

Finally, in the Midwest, where the shortage of open space for outdoor recreation is more limited than in any other part of the country, the unit at Chicago, Illinois, is attempting to improve the management of urban forest resources to enhance recreational opportunities that can be made available to urban residents.

Forest Service Urban Forestry Assistance Programs

The objective of the Forest Service Urban Forestry Assistance Program is to improve the quality of life (environmentally, economically, and aesthetically) in urban areas.

Urban forestry assistance is provided under authority of the Cooperative Forestry Assistance Act, section 6. Assistance includes educational and technical urban forestry assistance to State and local government units. The cost of these activities is shared by the State forestry agencies (or through subgrants to local government units and others) and the Forest Service.

Technical assistance is provided for a wide array of activities, including planning, establishing goals and objectives for urban forest resources; tree planting; and advice and training in the selection of species, including care and maintenance. This program includes assistance in the management of the urban forest resource (e.g., pruning, removal, pest control, stress testing, etc.). Advice is also provided for the marketing and disposition of urban wood wastes and for demonstration projects and pilot tests, including species adaptability, cultural practices, management alternatives, and urban tree evaluation. The Forest Service also supplies assistance in the promotion of special programs, including Arbor Day and Tree City USA, and for urban development or renewal, including advice on the protection and management of the existing urban forest resource in both urban areas and potential urban areas. Training is provided in a number of areas including the promotion and presentation of training sessions, workshops, and seminars to develop and expand the expertise of any and all personnel, in both the public and private sectors.

The Future

At present, the Forest Service Urban Forestry Research and Cooperative Programs are small in comparison to other agency programs. But, as future demands for urban forest benefits grow, and there is little doubt that this will occur, these programs will be expanded in number of units and scope of activity. Greater emphasis will be placed on research needed to care for and protect urban forest systems and to develop management systems that include all components of the urban forest—trees and associated plants, soils, water, and wildlife—and the manmade structures that influence the entire system.

How can we be so sure that the importance of urban forest resources will grow in the future? Here are just a few reasons:

- People are moving to cities and many public programs will be directed toward cities.
- Political influence is shifting toward urban areas, along with population.
- Energy availability and cost is shifting demands from rural to urban areas.
- Tree insect and disease infestations (e.g., Dutch Elm and Gypsy Moth) have increased public awareness of the value of urban forest resources.
- Urban-suburban-rural expansion has created more manageable open space near the urban fringe.
- Urban areas are being renovated.
- Zoning and new land development systems have created more open areas in and near urban areas.
- Public concern for environmental values is growing.
- The physical form of the typical city is changing—cluster housing, the move toward multifamily dwellings, increased public transportation, etc.—creating new manageable urban forest and open space resources.

Summary

Those responsible for management and planning of urban forest resources must strike a balance between the needs of people and the ability of urban forest systems to fulfill these needs. Through

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Urban forests provide environmental education opportunities for nearby residents.

development of new research knowledge and technical assistance, the USDA Forest Service is trying to do its part to improve the capacity of urban forest resources to produce needed benefits.

Urban forestry is really nothing new—it is merely a way to coordinate and plan the many activities that affect, and are affected by, urban vegetation.

The "urban forester" manages the vegetation, soil, water, and wildlife components of the urban forest system to create a more comfortable and healthy urban environment—an environment made more appealing by altering some of the glass and concrete monuments man builds to signify his dominance over nature. Urban forests are an extremely valuable resource and their importance will increase. Through proper management based on research knowledge, urban forests can produce a continuing flow of benefits for centuries to come.

George Moeller is Principal Urban Forestry Scientist, Forest Environment Research Staff, USDA Forest Service, Washington, DC.

Resource Management in Visitor Use Areas

by Jonathan B. Jarvis

Visitor Use

As the American public continues to seek weekend escapes from the hustle of urban and suburban life, outdoor "natural" recreation facilities within an easy drive of major metropolitan centers will begin to show the effects of increased visitor use. Land managers charged with managing and protecting forested areas, while at the same time offering a myriad of recreational opportunities, must be well versed in the principles of recognizing, anticipating, managing and correcting the impacts associated with active visitor use.

Prince William Forest Park, administered by the National Park Service, is an area where the principles of resource management for visitor use are being actively applied. Located only 35 miles south of Washington, DC, Prince William Forest Park is within a 45-minute drive of over 3 million people. Annual visitation has doubled since 1970 and is now over 500,000. The major attraction is the approximately 11,000 acres of forest, teeming with the native flora and fauna of the eastern piedmont region. The park visitor may come only for the day, to hike on the 35 miles of trails, or to use one of three picnic areas. Overnight visitors can utilize one of three park-operated campgrounds, the concessionaire-operated travel trailer village, or one of five group cabin camps. Though reasonably distributed over the park's land area, each of the park's 12 visitor use areas shows both unique and common impacts associated with recreation.

Visitor Use Impacts

Unique impacts are often the result of site-specific location, such as degree of slope, soil type, age of facility, frequency of use, or facility design. Common impacts are those that can be recognized at any recreational facility that receives regular use. The park campgrounds, because of their regular occupancy, develop a "lived-in" look and illustrate classic examples of visitor impacts. Impacts that are regularly observed in but not restricted to campgrounds are:

Lantern burns: A lantern hung on a nail or a low limb adjacent to, or in contact with, the trunk of a tree for one evening will kill the cambium or growth layer of the tree directly under the bark nearest the lantern. This result is not observed the morning after, but months later when the bark sloughs, leaving an unsightly open wound on the tree.

Tree injury: Carved initials (the bane of the American Beech), axe marks, knife throwing marks, wire and rope burns from tent lines and clothes lines, and cutting limbs and small trees for tent stakes and poles are all types of tree injury. Occasionally vehicle collision scars are seen, particularly in campgrounds allowing large trailers but not designed to accommodate their movements.

Soil compaction: The constant tramping of feet, the placement of tents, the driving of vehicles, and the absence of a thick layer of organics such as wood chips or leaves will usually result in soil compaction. As the soil is compacted, some tree roots become exposed and subject to injury, while others are sealed into airtight soil, preventing the necessary respiration.

Vegetation loss and site growth: As the camper seeks to retreat farther from access roads and other campers, or to the "greener side of the fence," the campsite grows as more vegetation is cut and/or trampled to accommodate a tent. Tent staking, drainage trenching, and bed-digging results in vegetation loss and, frequently, erosion.

Fire rings: Campfires built out of the established fireplace or grills may result in, depending on their placement, more vegetation loss, tree root death, tree trunk and limb scorch, and a generally inaesthetic campsite.

Observable Results

If left unchecked, the above impacts will have a marked effect on the appearance and the life of a recreational facility. The trees of a forested visitor use area are likely to be indicators of the facility condition. As any forester will state, the health of an individual tree is based on the number and degree of stresses placed on its system. Natural stresses such as insects, disease and drought claim a natural number of trees. When these stresses are combined with man-induced stresses such as lantern burns, soil compaction or other tree injury, tree health declines and mortality increases. Man-induced stresses do not generally claim the trees.

However, they do increase the tree's susceptibility to natural stresses such as insect defoliation and extended drought. Tree decline in vigor can often be recognized by a marked die back in the canopy and the occurrence of sprouts, i.e., short, leafy limbs emanating from the trunk. Trees showing such signs of severe stress are often beyond saving. The end result may be dead or hazardous trees that require removal for public safety, with an eventual reduction in tree stand density. One would expect that this opening of the canopy would encourage young replacement trees to quickly fill the gaps. However, it is more likely that the endless search for the tent pole, the tent stake, or the hot dog stick has reduced or eliminated the replacement trees. This loss of both the over and understory has long- and short-term effects.

Prince William Forest Park

Chestnut oaks in campground show severe die back and sprouting resulting from combined stresses.

Multidisciplined Approach to Prevention and Management

As a National Park Service area, Prince William Forest Park is charged with preserving and protecting, and at the same time managing its natural resources for public recreation. The park is given a budget and a staff administratively divided into Administration, Maintenance, Visitor Protection, Interpretation, and Resource Management to carry out these responsibilities. The Resource Management staff plays an active role in coordinating the energies of all of the park staff towards the prevention and mitigation of visitor recreation impacts. To ensure the long term preservation and quality use of the park's facilities, the following are considered essential programs:

Staff Awareness: A well-trained, informed, and concerned staff is the key to the success of any resource management effort. In-house resource awareness discussions, slide shows, and informal training sessions increase the perceptiveness of park staff. They in turn pass this on to the visitor. Resource-aware park staff will recognize, report and/or mitigate impacts and apply resource protective techniques in their daily duties. Involvement of park staff from all divisions in visitor use area rehabilitation projects is an excellent method of increasing awareness.

Environmental Education: The park interpretive staff and the Visitor or Nature Center provide logical avenues to reach the public with resource protective messages. Campfire programs, school programs, and demonstrations can include resource awareness messages or can use resource protection as their principal subject. When visitors are aware of the impacts they can have on an area, they are less likely to leave damage.

Publications, Brochures: Visitor use area bulletin boards and registration offices are good locations to display and distribute hand-outs that increase visitor awareness. Some very good brochures are commercially available while others can be produced in-house with park resource specific messages. A resource management message is included with all camping applications.

Rules and Regulations: Title 36 of the Code of Federal Regulations, Parts 1-7 and Part 50 provide the NPS resource protective rules and regulations that assist in the management and preserva-

tion of visitor use areas. The public can be made aware of these rules and regulations through hand-outs, signs, and other discrete methods that remind them of the "outdoor code of conduct."

Law Enforcement: Park staff trained in carrying out law enforcement duties must be well versed in the resource problems of the park. They can courteously remind visitors of minor infractions and seek immediate solutions to visitor activities that endanger park resources. Intentional or repetitive disregard for park resource regulations may have to be dealt with through the federal court system. At Prince William Forest Park, money has been awarded by the courts to compensate for turf damage repair and/or tree replacement. A park law enforcement staff that is trained to recognize visitor activities that have long term resource impacts will prevent many problems from requiring future management.

Impact Monitoring Program: Some impacts associated with visitor use are dramatic and their results are seen immediately, such as the cutting of vegetation. Others require years to appear. This problem of impact delayed response, coupled with staff turnover, can be dealt with through accurate documentation of site conditions. This can be accomplished through photoplots, diagrams and/or vegetation surveys.

Regular Maintenance: This important aspect of visitor use area longevity is often restricted to litter pick-up. When applied, a conscientious maintenance program can increase the useful life of an area for many years. Regular maintenance should remove hazardous trees, maintain trails, provide ground cover with vegetation or wood chips, correct erosion problems, and repair amenities such as picnic tables and grills.

Prince William Forest Park

Youth Conservation Corps enrollees performing campground rehabilitation by installing fire grills.

Site Rotation and Visitor Use Limits: Every visitor use area should have an established visitor capacity and these limits should be strictly observed. Use limits should be based on impacts rather than on visitor demand. If impacts are beyond what is expected, use limits may be reduced. On a periodic basis visitor use areas should be closed to all use. The period may be designed to occur off-season but ideally should extend at least one and preferably two years at a time. A rotation system can be established where there is no net reduction in facilities available for visitor use at any one time. These periods of closure allow needed maintenance, hazard tree removal, plantings, soil treatment and a "rest and recuperation" for the vegetation.

Area Rehabilitation

Faced with the problem of facilities that already show signs of severe stress from use impacts, the land manager can apply several techniques to rehabilitate the areas.

Area closure: Areas showing signs of stress may be closed for indefinite periods to stabilize and/or prevent further decline. These areas may remain closed until such time that rehabilitation has rendered the site capable of dealing with additional man-caused stress.

Soil conditioning: Site conditions may be the result of poor soil fertility, compaction, or pH. These can be tested and compared with "control" areas in the park where visitor impacts are absent, or with historical data on the specific area. Fertilization or liming may be required but more often soil aeration is all that is necessary. There are commercially available aerators which require a tractor for operation. An energetic group of volunteers, YCC or park staff armed with pick mattocks can achieve comparable results by punching holes in the soil. Rototilling is destructive to the tree feeder roots near the soil surface and should be avoided. Wood chips spread evenly over exposed soil areas will serve to retain moisture and prevent soil compaction.

Revegetation: After surveys determine species ratios, native tree and shrub species may be commercially purchased, park-raised or transplanted from utility corridors to replace vegetation lost to visitor use. Trees and shrubs should be placed strategically so as to provide all of the benefits associated with a naturally occuring tree or

Prince William Forest Park

Large lesion on maple in campsite resulting from lantern hung from nail, which has been removed.

shrub, but in such a place as to minimize its injury from visitor use.

Redesign: Some areas may require redesign based on visitor use patterns. Old trails may be replaced by newer, more easily maintained trails. Fireplaces and/or picnic tables may be moved slightly to shift impacts away from areas showing stress. Redesign may include reduction in facilities or site relocation. At Prince William Forest Park, certain campsites were determined to be too close in proximity to others, thereby concentrating impacts and preventing the growth of vegetative screening. In each case one or more campsites were removed and the site revegetated.

Tree repair: On a regular basis resource-aware personnel should conduct visitor use area "walk-throughs" to survey tree conditions. All nails and low limbs with the potential of holding a lantern should be removed. Tree soundness should be tested as part of a complete program to determine safety hazard potential. Areas around trees determined to be a hazard should be closed until such time as the hazard is eliminated. This may involve limb removal, horticultural stabilization, or tree removal. Tree injuries should be repaired to promote rapid healing. Wound dressings may be applied for aesthetic purposes and may, as a sign of active tree repair, deter future tree injury. Any ropes, string or wire should be immediately removed from the tree.

A Responsibility to Manage for the Future

The responsibility of the National Park Service to manage lands for preservation and use for future generations has been established by Congress. Though specific enabling legislation may vary, field resource managers from all parks must deal with visitor use impacts. One of their responsibilities is to manage that use so the quality of the visitor experience is either maintained or enhanced. The keys to managing park resources for active visitor use are: 1) Cooperation among park staff; 2) Education of the public; 3) Knowledge of the resource and 4) Application of active resource management techniques to the impacts as they are anticipated and recognized.

Jonathan B. Jarvis is Resource Manager for the Prince William Forest Park.

Wildlife in City Parks

by Thomas M. Franklin

USDA Soil Conservation Service

Opossum and babies rest in a Flood Prevention Structure.

Wildlife is an extremely important component of the urban environment. It is part of our American heritage and is deeply engrained in our culture. Studies show that urbanites enjoy observing wildlife near where they live and work, and some even suggest that time spent in natural surroundings is both psychologically and physically beneficial. Recognized urban wildlife values include aesthetic, economic, ecological, educational, practical and scientific.

A basic tenet of wildlife management states that wildlife must have food, cover, water and breeding space to survive. The principal objective in managing wildlife in urban forests and elsewhere is to satisfy these requirements for the desired animal communities. Effective wildlife planning and management requires knowledge of the recent historical ranges and local occurrence of wildlife species, the status of existing wildlife in the area, the extent to which the requirements of the desired species are being met, and the potentials of the area for existing and other desired species. Park and recreation managers should work with qualified biologists in government and the private sector to obtain the necessary biological information. Steps for integrating wildlife considerations into urban areas are detailed in the manual *Planning for Wildlife in Cities and Suburbs,* available from the Urban Wildlife Research Center.

Planning for the Future

Potential park areas being considered for acquisition present the greatest opportunities for wildlife enhancement. These areas should be carefully inventoried to ensure that especially valuable habitats are identified and to avoid severe impacts from possible future

M. Fleming, National Park Service

Stream bank stabilization plantings and natural meadow protect creek from erosion.

park development efforts. Parks can be linked to other natural areas via flood plains, steep slopes, wetlands, and rights-of-way. These linkages should be made with undeveloped tracts such as cemeteries, golf courses and other "natural" areas which may provide a reservoir and travel corridor for urban wildlife.

Many wildlife species show a strong affinity for woodlands. Corridors which are predominantly wooded or have dense shrubbery will help buffer the effects of human disturbance. Portions of the corridor that are not wooded should be planted with woody vegetation attractive to wildlife, or allowed to develop into shrubs and trees through natural succession.

Habitat Diversity

Research has shown that habitat diversity influences the variety of wildlife. If food, water, and a variety of attractive vegetation are found in proximity to extensive edge habitat, conditions for wildlife are likely to be favorable.

In planning for the maintenance or renovation of city parks, diversity of vegetation should be emphasized, and natural stream systems tributaries and wetland areas should be preserved.

Understory vegetation in many established urban parks is often removed and attempts are made to establish grass. Areas which contain only mature trees and mowed grass are usually unproductive of a variety of wildlife. The lack of shrubs, saplings and tall herbaceous ground cover negatively affects wildlife.

It is also important to retain dead trees or dead limbs where they do not pose a hazard to people. If some of these trees were left standing and if fallen leaves, trees, and limbs were left to decompose on the forest floor, there would be decided benefits to wildlife. In most urban forests, organic "debris" is cleaned up and disposed of as it is produced. Leaf fall is one of nature's ways of recycling nutrients. In addition to improving soil conditions, these materials provide important habitat for small animals and plants which in turn are a food source for higher animals. Therefore, these materials should be allowed to remain undisturbed on the forest floor wherever possible.

Less frequent mowing of grass-covered areas, especially around woodland edges, will improve conditions for many kinds of wildlife and will reduce maintenance costs. Cessation of mowing will result in the growth of natural meadows and, if left unmowed for a period of years, areas will develop into woody vegetation in the course of plant succession. When shrubs and trees reach the desired stage for wildlife purposes, the selective use of herbicides, mechanical brush-hogs or cutting can be used to keep the vegetation at that stage.

At Rock Creek Park, a heavily wooded, 1,754 acre area located in Washington, DC, the National Park Service initiated a progressive program to diversify habitat and wildlife in an attempt to increase opportunities for nature interpretation, recreation and environmental benefits. The Rock Creek Park "Meadows Program" was

initiated in 1976 by the Resource Management staff. After meadow sites were carefully identified, mowing was reduced during the growing season and detailed vegetative and wildlife survey records were kept to document changes. Although the Meadows Program was initiated for the above reasons, increased energy costs and inflation continues to affect park budgets and the economic incentive for reduced mowing becomes significant. Indeed, annual costs for maintaining an acre of lawn in Rock Creek Park averages about $1,300, including the costs of labor, machinery, seed, lime and fertilizer. The annual costs of maintaining an acre in meadow is negligible inasmuch as meadows must be mowed only once per year in late summer to control woody vegetation.

In downtown parks, shrub plantings are especially important. Shrubbery and understory vegetation are essential for substantial songbird populations. As a means of enhancing and maintaining natural diversity, shrubs should be encouraged in woodlands and the use of native species in landscaping should be emphasized.

Most urban parks lack "weed seeds" which are quite attractive to wildlife. The planting of annual wildlife food plots (e.g., millets and sorghum) or wildflower plots can provide substitutes for these seeds. Plots can be visually attractive when properly integrated into the landscape and may be substituted for the traditional flower beds which require considerable labor and materials to maintain.

People should be encouraged through public relations and education to appreciate a more natural species-rich concept of a park. Carefully laid out nature trails will help promote conservation education and enjoyment of nature by residents or visitors to the park.

M. Fleming, National Park Service

Fallen trees should be allowed to remain on the forest floor to decompose naturally.

Park and recreation managers should be aware that urban woodlot management practices may affect wildlife in different ways. For example, if maximum diversity and numbers of wildlife are desired, openings may be created in woodlands. These openings will allow additional light to penetrate to the forest floor, thereby encouraging the growth of species which prefer sun through the process of natural succession. Woodland openings may be planted with herbaceous plants and shrubs attractive to wildlife to obtain a more immediate effect.

Negative Effects

Some recent research, however, has shown that fragmented forests may negatively affect certain species. For example, many migratory species of birds depend on large, unbroken tracts of forest. Although bird populations in the interior of extensive forests are relatively low in total numbers, life history studies in the eastern deciduous forest indicate species that winter in the American tropics have certain common characteristics which make them dependent on extensive forest tracts during their breeding season. Warblers, vireos, thrushes, and flycatchers are affected in this way. These families of birds are subject to increased predation from pets, wild predators, people, and cowbirds near wood margins, hedgerows, and forest openings. Long term studies conducted in Glover-Archbold Park and Rock Creek Park in Washington, DC indicate that the long-distance migrants decrease when a large forest is broken into smaller tracts and isolated from a source of repopulation.

Dead trees provide habitat for a variety of wildlife.

M. Fleming, National Park Service

The park resource manager must therefore decide whether they wish to promote more diverse and numerous wildlife populations or whether they wish to maintain species which are dependent on large, intact woodlots when considering woodland management projects.

Human usage of urban woodlots with associated disturbance of wildlife also should be considered in park planning and management. Most urban wildlife species are tolerant of limited human disturbance. Human activity can negatively affect wildlife during the nesting season. Therefore, when planning the location of trails, camping areas and the like, consideration should be given to locating them near the edge of the forest or away from ecologically sensitive areas.

Water Areas Provide Habitat

Wooded streams, ponds, lakes and wetlands provide valuable habitat in many urban forests. They are often rich in plant and animal life and offer excellent opportunities for ecological education and nature-oriented recreation. In planning and managing water areas in urban forests, attempts should be made to: preserve existing high-quality streams and other water bodies; improve those that need improving; and create additional impoundments or wetland areas where practical. Elimination of water pollution and retention of natural features are beneficial to wildlife. In degraded urban streams, rehabilitation structures should be developed so that the hydrologic features resemble unchannelized streams and the conditions for aquatic life are similar to natural streams.

These water areas can also attract a large variety of wildlife and fish. Impoundments with gently sloping margins, with associated growth of emergent and submergent aquatic vegetation, should attract birds, reptiles, and amphibians. A multipurpose pond can be created if the pond contains shallow water around the margins for wildlife, deep water in the center for fish, and a water level control structure for management purposes. Marshes and wooded swamps should be preserved whenever possible for their many ecological values.

Various kinds of nesting boxes may be erected in urban woodlands, especially those that have few trees with cavities for tree-nesting or denning wildlife. Wood ducks, hooded mergansers, goldeneye ducks, screech owls, tree swallows, great crested flycatchers, saw-whet owls, sparrow hawks, bluebirds, gray squirrels, fox squirrels, and flying squirrels are examples of wildlife that can be attracted to artificial nest boxes in and around urban woodlands if their other habitat requirements are present.

Brush cut for road and trail maintenance may be piled near woodland borders to provide valuable habitat for species ranging from bacterial composers, to fungi, wood-boring insects, amphibians, reptiles, birds and mammals. Similarly, rocks piled loosely in locations near food or cover can provide cover for ground squirrels, snakes and lizzards.

There are limitless opportunities for integrating urban forestry and wildlife concerns into urban forest management programs. Park and recreation managers play an important role in promoting a comprehensive approach to urban forest management including the enhancement of wildlife values for the benefit of park users.

Tom Franklin is the Executive Director of the Urban Wildlife Research Center in Columbia, MD.

Forestry in Planning and Development

by Gary A. Moll

Maryland Forest Service

Urban forester views red and white oaks. Because of poor grading techniques trees will die within 3-5 years.

No one seems to know just when it all started. There was a general change in philosophy with the demise of the American Indian and perhaps the inertia of our pioneering spirit drove us blindly through the industrial age to the present. However, with all our progress, we have overlooked some critical data. We have the ability to make massive changes in the structure of the earth's surface, yet we neglect to incorporate existing land and water features into our land development designs. We have learned how to pipe water off our street but not how to handle increased flows at major collection areas.

Natural Systems

Urban development is a land use and urban areas are part of the natural system. The function of the natural system will continue regardless of land modification. Developed lands become part of the natural system, no matter how incompatible it might be. We will always have weather and water will always flow down hill regardless of politics or social change. These existing natural systems are losing battles or at best, very expensive ones.

Urban foresters are contributing information on natural systems during the development process. This application of forest management principles to land planning is a concept long overdue. An Amish man once told me that "good judgment comes from experience; experience comes from bad judgment." Hopefully, we have had a large enough dose of experience from past land development practices to enter the era of good judgment.

Maryland has had its share of experience. Over the last ten years the state lost 325,000 acres, or 13% of the total of its forest land, to other land uses.

The most significant of these uses has been land development. These changes in land use lead to changes in other elements of the system. The Chesapeake Bay, of which Marylanders are so proud, shows significant strain from poorly designed land development. Soil sediment and radical fluctuations in fresh flow can also be added to our list of bad judgments.

Designing with Nature

Designing land development with existing natural features makes a lot of sense and can solve some significant problems. The sediment load from land under construction for urban housing is 1,000 to 2,000 times as heavy as the sediment load from a forested site. Also, the quantity of fresh water flushed from the land under construc-

Maryland Forest Service

Because single trees were not protected during development process, they show distinct signs of demise a year after development was completed.

tion for urban housing after a storm is increased. This water does not flow to the Bay in a regulated manner as it would from forest land. A tremendous maze of pipes and corridors has been engineered to send this water to the Bay express style. Thus, the aquatic life which depends on a specific percentage of salt in its water for survival suffers under this system of increased volume and velocity.

The details go on and on. A land developer can make many savings by designing with nature. Expenditures for storm water management and sediment control are greatly reduced by utilizing existing resources. When forest vegetation is retained, the selling prices of homes are increased by 7-10%. The careful marketing of selected trees in the development process can improve the health of trees retained in a stand while producing a profit for the owner.

The Southern Maryland Program

A successful urban forestry project was started in Southern Maryland in 1976. The forester's techniques have been accepted by both the local governments and land developers. A three prong approach was used. The forester works with the county planning agencies and land developers while operating an information and education program.

County planners' responsibilities include creating or maintaining their county's master plan, zoning ordinance, and subdivised regulations. Each of these items is a potential vehicle for incorporating the important features of forests and trees. One of the county planners is attempting to use the soil series map available from the Soil Conservation Service as a basis for developing the county's master plan. This is an excellent technique and is ideal for our use. However, it is not necessarily popular with land speculators or all landowners. In support of these efforts, the forester constructed a forest-type map showing prime and productive forest lands in the planning area. The map showed a trend toward concentration of heavy development in the most productive forest areas. By joining forces with the planner, both forestry and planning causes were benefited.

This lesson was also learned by working with the Soil Conservation Service. In one of the counties where the planning agency was a little lazy, independent efforts of both the Forest Service and the Soil Conservation Service were frustrated. After the two services combined forces they started to experience clout.

Working with the Developer-Builder

Work with the developer-builder has been the most expedient method of retaining forest vegetation. The developer-builder is the action man in the development process. He takes a dim view of the bureaucracy but will consider a good business offer.

Maryland Forest Service

Forest vegetation and other site features have been retained. Erosion control and storm water management are built into this natural system.

Show the developer that retaining vegetation will increase his sales volume and increase the selling price of his home, and you will have his ear. The Southern Maryland program concentrated its efforts on the operations that were sincere about working with nature's features. Almost every developer is different, so the techniques must be tailored to fit his operation.

A large housing project is a likely candidate for a "full blown" mapping of existing natural features. We have used this approach with an 8,000 acre development project in Charles County. This project develops neighborhoods of 200-500 acres at one time. Detailed maps of existing vegetation, topography, and soils can be constructed of the area. By putting each natural feature on a transparent sheet and overlaying these important factors, a logical layout of the neighborhood can be determined. Properly used, this method greatly reduces the impact on the vegetation and existing natural drainage patterns. It also saves future homeowners many headaches. However, the overlay method requires a close working relationship with the developer and ample lead time to complete the work. The detailed soil survey takes about a month.

Most of the smaller developers are not set up to take in this much detailed information. With them, it's best to work in steps. A good starting point is to mark the desirable trees on his lots and help him solve the problems of construction damage to the vegetation. As the working relationship progresses, the builder will be receptive to making changes in housing and driveway locations to accommodate the vegetation. One developer in St. Mary's County now uses our support to obtain approval of special exceptions with the planning commission as he endeavors to build with the existing natural feature.

Information and Education Program

An information and education program is essential for our operation. The general public and key county officials in this rural area are not aware of the consequences of urban sprawl or are they aware of the tools that can be used to control this process. The use of techniques such as cluster developments increases the opportunity for retaining natural features.

Written materials for handouts along with slide presentations to developers and county officials are all vital to the program. The newspaper is, of course, another key resource. Simply stated, to be successful the message must get to the decision-makers. The message sent must be full of facts. If problems are pointed out, solutions must also be presented.

Role Models

Analogies are important educational tools. As part of the big picture, we can benefit by exploring some of the intensive forest management areas in Europe. Europe has a longer history than we do and has learned from experience the value and importance of forest land. In many cases, they have had to learn the value the hard way, from destruction or overuse of the resource. This is the lesson we can avoid by looking at some success stories.

In Zurich, Switzerland, for example, there is a forest right in the city which is under sustained yield forest management. This forest produces $80,000 per year in forest products, enough to support the cost of forest management and other city government costs as well (Clark Holscher, The Metro Forest, November 1973).

Gary A. Moll is an Urban Forestry Coordinator for the Maryland Forest Service's Urban Forestry Program.

Recycling Trees: Upgrading an Urban Forestry Program

by Roger Moellendorf

Fremont Parks & Recreation Dept.

Holding nursery is located in the municipal cemetery managed by the Parks and Recreation Department.

How does a small municipality go about replacing trees lost from Dutch Elm Disease and other causes during an era of budget limitations and tax lids? The answer in Fremont, Nebraska, may be recycling the old trees into new ones.

Fremont is a typical mid-western city of approximately 24,000 people in northeastern Nebraska. Like other cities Fremont has been ravished by Dutch Elm Disease (DED). The toll has been staggering; nearly 75% of the American Elms have been lost, resulting in a tremendous need to replant trees. This need for replanting becomes even more apparent when you consider the results of a 1967 Street and Park Tree Inventory which found that 62% of all city trees were American Elms.

DED Sanitation Program

Dutch Elm Disease did, however, create one benefit: that was the creation in 1967 of a City Tree Board, Tree Ordinance and Forestry Division. The Parks and Recreation Department was given the responsibility of enforcing the tree ordinance and implementing an aggressive DED sanitation program on all public elm trees. This DED program included spraying all public trees with DDT, and removing and disposing of all infected elms as soon as possible. After DDT was banned, spraying with Methoxychlor continued for about two years. Eventually, all spraying was stopped because Methoxychlor was about three times as expensive as DDT and possessed a much shorter residuum. The potential benefits of the spraying program no longer exceeded the costs.

Removals of diseased elms still received the highest priority and were conducted year round with the bulk removed during the growing season. Trees were taken to a public landfill four miles east of town. By 1975 over 61% of all elms (inventoried in 1967) had been removed.

Even with the DED program, casualties continued to rise. Today elms make up less than 15% of the street and park trees. The number of elms removed has dramatically leveled off since 1978. In 1980 the number of elms removed was about 11% of the total in 1975. This decline is probably due in part to a great reduction in the number of susceptible species of elms and the smaller

percentage of elms in the total urban forest. This low amount of elms removed should remain stable for the next few years, with or without a sanitation program. In light of these facts, the Parks and Recreation Department decided to take a long look at its DED policy.

In order to increase the Forestry Division's efficiency in all phases of Urban Forestry, from removing and disposing of dead and diseased trees to the maintenance of existing trees and the planting of new ones, the Parks and Recreation Department decided to de-emphasize DED control. Four recommendations were proposed to the Park Board and City Administrator.

1. Discontinue an aggressive DED sanitation program.
2. Change our seasonal operations schedule.
3. Establish a tree holding nursery.
4. Sell firewood from tree removals to finance the nursery.

Tree Removals

The Forestry Division decided to save all removals (including diseased elms) except potentially hazardous trees for the winter season. One tree removal survey during the first week of September 1980 was sufficient to identify, mark and record all dead and diseased trees. Removing trees during the winter has had several advantages.

1. Removals were easily identified with only one survey, allowing the crew to make only one pass through the city. This eliminated returning several times to one location in order to remove trees which show DED symptoms at different times of the year.
2. Damage from falling trunks and limbs is minimized due to frozen lawns.
3. The outdoor work load is more evenly distributed among the seasons. Winter was historically the Forestry Division's "slow time." Removing trees in the winter leaves more time in the spring and summer for planting, watering, fertilizing and pest control.
4. Removing trees during the winter permits more work days outdoors than trimming does. It is easier for the crew to keep warm on the ground doing removals than it is above the ground trimming.
5. Trimming street trees for height clearance in the past was started after the removals were finished, usually in the fall and winter. Trimming trees in the spring and early summer is better because the tree recovers from the pruning wounds much faster this time of the year.
6. Flexibility. Storm-damaged or potentially hazardous trees can still be removed or repaired whenever the need arises.

When removing a tree, firewood (any piece four inches in diameter or greater) is sorted from the brush. By volume, approximately 70% of the average tree is firewood size. This firewood is loaded by a Prentice loader and hauled to a firewood lot about one mile south of town. The remainder of the tree is loaded and hauled to the public landfill four miles east of town. This automatically reduces dump and hauling expenses by around 70%.

The average street and park tree contains around 50 cubic feet of solid wood material. Removing 50 to 100 trees a year results in approximately 2,100 to 4,200 cubic feet of solid wood material a year to sell as firewood. This includes subtracting the 30% of brush the average tree contains.

Depending on weather conditions, all removals can be completed in one month. Most trees are removed during November and December. The Forestry crew spends the bulk of the winter cutting wood into firewood length and splitting the firewood with a homemade log splitter. The firewood is stacked into ricks 16″ × 4′ × 8′, which is a third of a cord.

Selling Trees for Firewood

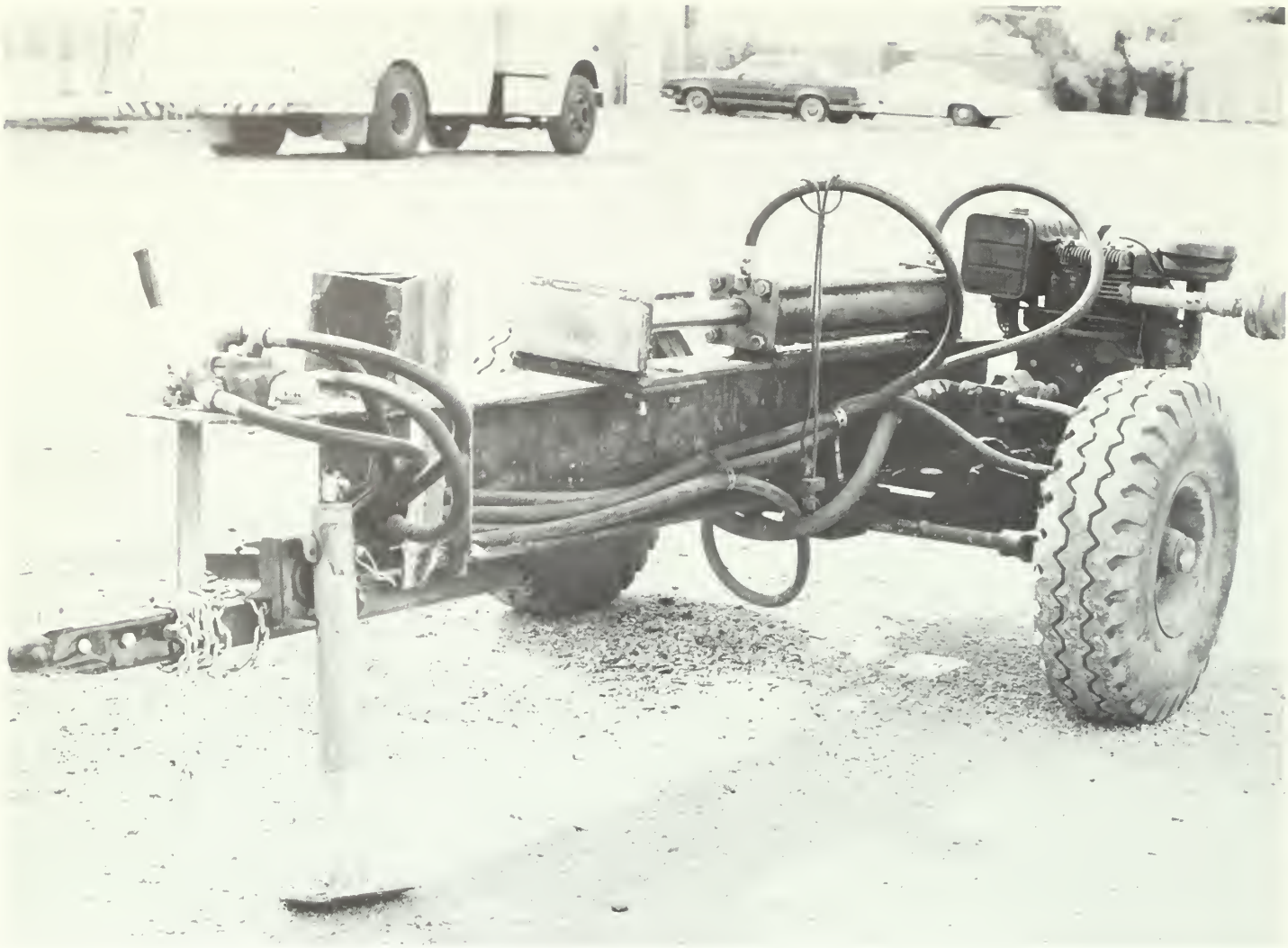
Firewood is sold by appointment only, and it is only sold by the rick or cord. Last year the wood sold for $20.00 per rick and $50.00 per cord. The price does not include delivery. Firewood sales have been very brisk.

American Elm isn't the only species sold. The most common species also include Green Ash, Silver Maple, Siberian Elm, Linden and Pin Oak.

The log splitter was built by the department's mechanic and consists of a seven-foot-long steel beam, a wedge built from scrap iron, a 14-horsepower Briggs and Stratton engine, a 2500 psi two-stage hydraulic pump, and a four-inch cylinder with a three-foot-long shaft. The log splitter is mounted on an axle with two, 12-inch wheels. It has a two-inch ball hitch and can be easily towed by a pickup truck. Construction of the splitter, not including labor, costs about $700. Two men operating the log splitter can split several cords a day.

Holding Nurseries

Money generated by the firewood sales is used for the purchase of new trees to be planted in the holding nurseries. Currently we have two nursery sites. The first site is located about three miles east of town at the sewage treatment plant. The other nursery is located in the municipal cemetery managed by the Parks and Recreation Department. Approximately 100-150 whips or seedlings are planted each year. The trees are staggered in double rows, with six feet between trees in a row, six feet between rows within a double row and 15 feet between double rows. This is adequate spacing for maximum tree growth and nursery maintenance. The trees will be left in the hold-



Fremont Parks & Recreation Dept.

This log splitter was built by the department's mechanic; construction costs were approximately $700.

ing nursery for five years before being transplanted with a tree spade. This should produce a one- to two-inch caliper tree and a rotation of 100-150 trees yearly.

The nurseries are watered once a week with a 2,000 gallon water truck. They are mowed whenever needed and Roundup is used for weed control. We are currently considering a drip irrigation system to reduce watering costs and crew time.

Holding nurseries are a good investment for several reasons:

1. The nursery beats inflation by purchasing trees five years ahead of transplanting time.
2. By purchasing smaller trees, more can be planted each year on the same size investment.
3. Variety selection is not limited to the type of trees local commercial nurseries provide.

Because these trees are relatively inexpensive, we can afford to experiment with different or unusual species. Hopefully, these experiments will provide a greater selection of trees which are suitable for this area. Some of the more unusual trees include: Kentucky Coffee-Tree, Amur Cork, European Red Elder, Bald Cypress, Pea Tree, Wild Black Cherry, Chinese Chestnut, Dawn Redwood and Lacebark Pine. A few trees have been obtained from the Nebraska State Forest Service's Clark-McNary Program and the Nebraska Statewide Arboretum.

The first trees were planted in the holding nursery three years ago. In 1983 the first trees will be ready for transplanting. These will include Honey locusts, Kentucky Coffee-Trees and American Lindens.

By recycling dead and diseased trees through firewood sales into new nursery stock, it will be possible to reforest the city at minimum costs, conserve energy, reduce removal costs, increase the Forestry division's efficiency and help supply a local demand for firewood. Fremont was once known for its beautiful shaded streets and parks and is striving to regain that reputation. The work must be paying off since Fremont has been honored with the "Tree City USA" award from the National Arbor Day Foundation the last two years.

Roger Moellendorf is currently the Forestry Foreman for the City of Fremont, Nebraska. He graduated in 1975 with a B.S. degree from the College of Forestry at Colorado State University. He has also worked for ChemLawn Corporation of Omaha and the Olympic National Forest seasonally.

Forests in the City

by Charmaine Ng

Chicago's Bureau of Forestry Parkways and Beautification

Parks situated along the city's lakefront help give Chicago its name "City in a Garden."

To provide a welcome relief from the urban scene, people have instinctively sought to bring part of the country to the city. What better way to achieve this than through the use of trees and open green space—living and breathing symbols of rural America. It is this concern for vegetation in our cities that led to the birth of urban forestry as we know it today. In 1973, urban forestry was defined by professionals in the field as:

> "a branch of forestry that has as its objective the cultivation and management of trees for their contribution to the physiological, sociological, and economic well-being of urban society."

The care and planting of trees has long been a part of the City of Chicago's heritage. Since its incorporation as a town, while covering only seven-eighths of a square mile, Chicago's motto has been "City in a Garden." As far back as 1917, the Bureau of Parks, Public Playgrounds and Bathing Beaches was busy maintaining more than sixty-five city parks. This small bureau was also laying the groundwork for urban forestry in Chicago by planting several thousand trees each year along its streets, avenues, and boulevards.

Today the City of Chicago has expanded to cover 228 square miles. The responsibility for its public trees rests primarily with two municipal agencies: the Chicago Park District, now responsible for more than 570 city parks, and the Bureau of Forestry, Parkways and Beautification, caretaker of an estimated 491,000 trees located on city parkways (between the sidewalk and curb). These public trees, when combined with the trees on private property, make up the greatest portion of our urban forest.

The Invaluable City Tree

City trees receive little or no attention for the benefits they provide. These unsung heroes of a cold concrete and steel environment modify the urban microclimate and make it more comfortable

for us, its inhabitants. Trees reflect solar radiation, giving us shade and coolness. A seventy-foot shade tree has been shown to transpire up to 100 gallons of water a day, cooling the surrounding area. It would take five room air conditioners to do the same job, but at a substantial energy cost. Just as they help to muffle the everpresent sounds of the city, trees also screen out unsightly views. They filter out air-borne particulate matter and pollution, helping to purify the air. Through the process of photosynthesis conducted in their leaf tissues, oxygen is produced and added to the atmosphere. City trees provide food and shelter for various forms of wildlife. By enhancing homes and gardens, trees increase property values by as much as 6 to 9 percent. Barren pavements and sidewalks come to life visually through the colors and softness they provide.

Chicago's Bureau of Forestry, Parkways and Beautification

Chicago's Bureau of Forestry, Parkways and Beautification

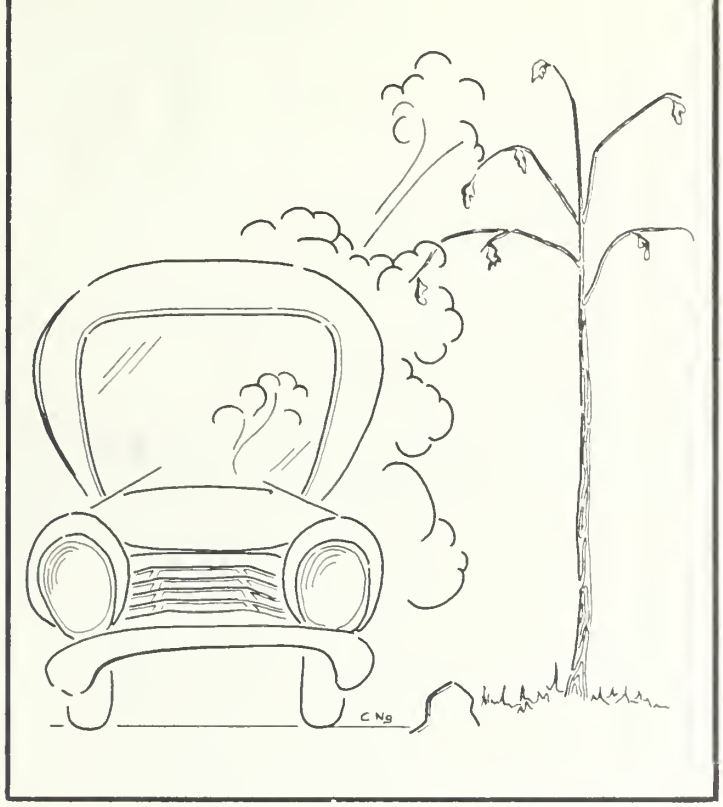
Proper care of city street trees creates an urban forest to be proud of in summer and winter.

Urban Conditions Far From Ideal

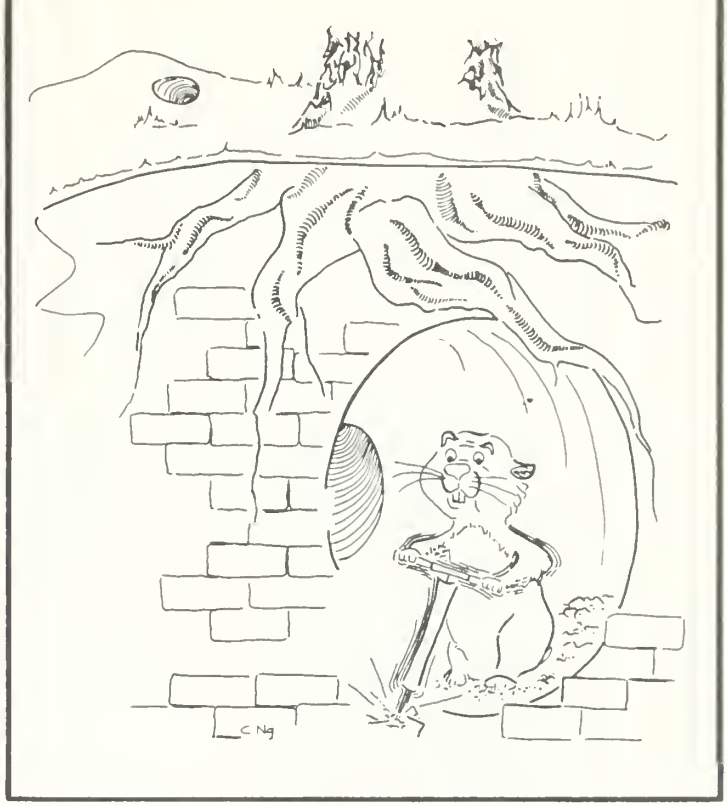
Although a city tree may offer several amenities to a city and its residents, the urban environment in which that tree is forced to exist does little to encourage healthy, vigorous growth. Trees found in community parks or on private property are definitely hampered by the harsh growing conditions. But it is the urban street tree that seems most negatively affected.

Pollutants, such as methane gas and volcanic dust, have existed naturally since the formation of the earth. Through many thousands of years, evolution produced trees capable of filtering out most of these natural pollutants. With the dawn of the industrial age and advancements in technology came new kinds of pollution. Old forms of pollution were introduced to the environment at higher concentrations. Vital leaf tissues, once so effective at purifying the air, are today destroyed by concentrations of the modern pollutants SO_2, O_3, HF, CL_2 and PAN. Parkway and boulevard trees situated along busy thoroughfares are hardest hit by pollution from automobile exhausts and toxic salts used in wintertime road de-icers.

Fertile soil will encourage vigorous plant growth when its structure is such that it allows dissolved nutrients to reach the vegetation's root system. If representative samples of parkway soils from large U.S. cities could be obtained, they would most likely show that construction work and excavation have drastically altered the naturally occurring soil profile. These disturbed soils, composed chiefly of clay in Chicago, greatly reduce a street tree's chance of survival. Subsoils brought to the surface of parkways and boulevards often lack organic matter and nutrients or hold essential nutrients in forms unavailable to the tree. Heavy traffic near these parkway areas or extensive working of wet ground have also created compacted soils. Pore spaces in the soil are reduced in size and number, impairing the gas exchange that must occur underground between tree roots and soil. Diminished root growth results and often leads to the general decline of street trees.



Parkway trees located directly off busy thoroughfares are plagued by automobile exhausts and street salts used for winter de-icing.



Compacted, poorly-drained soils in the city make it difficult for a tree to develop an adequate root system.

Charmaine Ng

Competition for space, an accepted part of life among city dwellers, also affects parkway trees. Overhead, trees are forced to contend with power and telephone lines. Visual access to street lighting and traffic signs takes precedence over trees. Height clearances must be maintained over sidewalks and streets for pedestrian and vehicular safety. Narrow parkways can provide such limited growing room that mature trees outgrow the confines of the parkway and begin to uplift the surrounding sidewalk. Of all available space in Chicago's parkways, underground space is at a premium. Roots of street trees are forced to compete with water and sewer pipes, gas lines, electrical cables and even parkway sprinkling systems!

Environmental problems are not the only ones facing the urban street tree. In several ways man is directly responsible for undermining the general health of the urban forest. The well-intentioned homeowner has over-fertilized, incorrectly pruned and, while mowing his lawn, scarred the trunk of newly planted trees. Cost-conscious construction firms neglect to place protective barriers around street trees. Traffic accidents occur where the only victim is the urban street tree. Vandals have long used knives, saws, paint and other toxic substances to kill unwanted trees. It should be pointed out that even if man-made conditions or environmental diseases do not kill a tree outright, they can lead to secondary invasion by insects and diseases that could be the ultimate killers.

A Plan for Action

Public awareness is the key to initiating a good management program for the modern urban forest. City residents and officials must be alerted to the benefits derived from city trees as well as to the adversities they face. The informed support of these individuals is essential before a firm legal basis for public tree protection can be established in the form of a city tree ordinance. Once law, such an ordinance can legitimately be enforced. The Municipal Code of Chicago includes an entire chapter devoted to the protection of trees, plants and shrubs. Additional ordinances, revised in 1967, gave the Bureau of Forestry, Parkways and Beautification the responsibility for "management and control . . . of street parkways and boulevards, all trees, plants and shrubs planted and to be planted in the public ways of the city." Not only have specific standards for street tree protection been established, but an agency has grown out of the need to regulate them.

Residents of a community shoulder most of the costs of a tree program. Through their taxes or monies acquired through group or individual efforts, it's likely that public awareness plays a vital role. Results of a good public education campaign may not be as awesome as Chicago's 1981 budget of $7,400,000 for its Bureau of Forestry, but not all communities maintain half a million street trees and can expect such large appropriations. Today, monies for maintenance and renewal of the urban forest are not readily available. Communities just becoming involved in city tree care should consider public funding of any amount a definite achievement.

Table I. TREES PLANTED IN CHICAGO'S STREET TREE PLANTING PROGRAM *

SPECIES	POLLUTION TOLERANCE	SALT TOLERANCE	TOLERANT TO WET SOILS	DROUGHT RESISTANT	DISEASE RESISTANT	INSECT RESISTANT
Acer platanoides	Cl_2,SO_2,O_3,HF	✓		✓		
Acer rubrum	SO_2,O_3		✓			
Acer saccharum	SO_2,O_3,HF,PAN		✓			
Corylus colurna				✓	✓	✓
Fraxinus pennsylvanica	Filters out particulate matter					
Ginkgo biloba	SO_2,O_3				✓	✓
Gleditsia triancanthos inermis	Cl_2	✓***	✓	✓**		
Plantanus acerifolia "Bloodgood"	SO_2,HF		✓		✓	
Pyrus calleryana		✓***		✓	✓	✓
Tilia americana	O_3,HF					
Tilia cordata	SO_2,HF				✓	
Tilia euchlora	O_3,HF					

* Tolerance ratings taken from Site Specific Tree Species Selector and Planting Guide, Dayton, Ohio, 1981.
** Source: "Roots: Caring for City Trees," by Ruth Foster, Technology Review, July-August, 1977.
*** Source: "Disease Stresses of Urban Trees," by E.B. Himelick, Better Trees for Metropolitan Landscapes, USDA Forest Service General Technical Report NE-22, 1976.

A good working urban forestry program involves several important aspects. Proper maintenance of existing trees should include a cyclic trimming program and, if the funds are available, fertilizing and spraying programs. Prompt removal of dead or diseased trees is necessary to prevent damage to persons and property, as well as to reduce the spread of disease and insect pests. Renewal of the urban forest is the primary objective of a city street tree planting program. Consideration should be given to planting a variety of species to prevent major losses caused by disease or insect outbreaks such as Dutch Elm Disease. These mixed stands of trees should consist of tree species noted for their resistance to disease and insects, environmental stress tolerance, general adaptability and winter hardiness. In its planting program, Chicago includes up to 12 species of trees recognized for their tolerances to adverse environmental conditions and/or their resistance to disease and insects. (See Table I.)

The parkway or boulevard tree is that "little bit o' country" city residents find right outside their front doors. As such, they are perhaps the most visible members of today's urban forest. A progressive view of the urban forest comes from John Dwyer of the USDA Forest Service. He states that in the future the urban forest will be recognized as an ecosystem, "that besides trees, it includes other plants, animals, climate and soils, water, and man and his works." Enlightening city officials and the public to the importance of city trees will hopefully result in the respect, and eventually, the protection and renewal of the urban forest as an involved system.

Charmaine Ng is City Forester II with the city of Chicago's Bureau of Forestry, Parkways and Beautification.

Interpretation of Urban Natural Areas

by Lurrie V. Pope

Interpretation is an educational approach adopted early in the history of the conservation movement to treat the problem of public apathy toward use and misuse of natural resources. The concept was introduced on the assumption that people would respond positively when learning that something of their own was at stake. Since then, interpretation has become one of several operational activities devoted primarily to protection of natural and cultural resources, and is considered organizationally one of the most effective devices for cultivating and preserving park values.

The interpretive program—consisting of demonstrations, talks, walks, hikes, observations and other activities—is designed to help participants better enjoy their visit to the park. If the program is to benefit the public, it should be distinguished by the following criteria: should support the mission of the agency, prevent additional resource damage, relate the hazards of resource misuse, instill in the visitor a protective/responsive attitude, advise the user of park policy and reasoning, detail the significance of the area and finally, encourage independent use and study.

Accepting the above as the required groundwork for an effective program, we learn instantly that the job of communicating and relating park values is tough. For it is virtually impossible to gauge visitor comprehension and reaction to such abstracts as appreciation, understanding and protection; and to the degree that these teachings are accepted, it would take several lifetimes to fully assess and realize their true impact.

Interpreters working in urban natural areas must keep keenly attuned to the condition and physical limitations of their resource and must keep equally attentive to, and knowledgeable of, the populations for which their interpretive programs are intended. The manner in which the public (principally urban residents) responds to our request for moderation in use, and the conduct that they exhibit when visiting other reservations depends in large part on their understanding of what the interpreter says and on the interpreter's ability to duly and significantly affect their work experiences.

William Clark, NPS

Visitors enjoy nature exhibits.

The Urban Forest

In a 1980 State of the Parks report submitted by the National Park Service to the Congress, it was disclosed that of the more than 300 National Park System units reporting, adjacent land use was cited as the major threat to parks. Also identified were aesthetic degradation, air pollution, physical removal of resources, exotic encroachment, visitor physical impacts, water quality pollution and water quantity changes, and park operations. Of all the impacts examined, we conclude that most can be significantly eased through sensible interpretive approaches.

To the distant observer, the relatively small size of Rock Creek Park (roughly 1,754 acres) might seem incidental, but to the two million urban users of the park each year, there is no compromising its value. To the residents of a growing community, the urban forest

means having at your doorstep a resource capable of providing natural scenery, spectacular overlooks, and recreational outlets typical of those produced by larger reservations. The diversity of the park is evident in its rich collection of historical, cultural and natural features, presenting the innovative employee with generous developmental options. Evidence of this innovation is reflected in the variety of interpretive programs which are designed to adequately address the urban forest and its attendant problems. One such program which drew much publicity, including coverage by a major newspaper, involved an activity entitled "Aliens." The program was prepared and presented to address the problem of exotic growth in the park, and was aimed at reversing this negative user impact. The program identified the alien growth, showed how exotic vegetation overtakes and chokes native plantlife, explained their origin in the park as well as related its consequence to the forest resource. This and similar activities reinforce the belief that nature is most rewarding when much of its cherished splendors are left in a natural and undisturbed state.

The Urban Park Visitor

Since the early 1900's when masses of rural residents began their move from farm to city, the need for natural areas has continued to grow. While a substantial and ample number of parklands (parks, refuges, reservations) are located in the west, most are too distant for frequent, effective use by urban residents—causing a disproportionate strain on reservations in the east. Additionally, 20th century developments and discoveries have given way to the production of more leisure time and more people seeking exciting ways to use it.

Today, visitors to urban natural areas make up one of the most diverse user groups imagined. Visitation reflects the ethnic and character makeup of the community, i.e., the very rich and the very poor; the able-bodied and the impaired; the young and the old; the citizen and the foreigner; the educated and the ignorant. For some, it is their first experience with nature; for others, it may be only one of many visits. Analysis of visitor use trends indicate that the reasons for coming are as varied as the individuals themselves. Newcomers approach the urban forest with innocence and hesitation, and should be delicately prepared for the encounter. This occasion gives the urban interpreter an unmatched opportunity to effectively integrate the users' background and experiences with the conservation discipline one wishes to be cultivated.

Urban interpretation must be designed for wide audience appeal, given the diversity and/or limitations of the audience. While personnel in remote areas are concerned principally with programming activities for one-time users, the urban center personnel must plan activities which capture the interest of a sizable number of repeat users. Employees that are hired to interpret cultural, historical and natural urban resources are fortunate because they have many opportunities to right a misconception or to restate a concept. Urban interpretation carries visitors from youth through adulthood, helping them to hear their first bird song, and as they grow older and crustier, it remains with them to share their excitement at the prospect of completing a sighting's card. Interpreters of natural areas are given many chances to reach and influence an apathetic public. Their effectiveness will be weighed against growing public appreciation as more and more people become responsible protectors of the environment.

The Role of Nature Centers

The nature center and its personnel stand as the park's front-line operation, with responsibility for promoting and teaching legitimate natural, cultural and historical resource use. The importance of its function is undeniable. The very nature of the activities offered by nature centers creates interest and attendance, even if just out of mere curiosity. Each activity offered has a definite direction and purpose. The weave of information, when combined, forms the foundation for true understanding of the complicated, yet delicate interrelations that are found throughout nature. Through exhibits and other programs, nature centers recreate the forest scene and relate the wilderness with elements for which the visitor is familiar.

Planetarium and star programs illustrate the influences of time and space on the earth and its people in terms of climate, weather, the seasons. Live animal demonstrations are structured to allay fears and misconceptions, and to teach respect for the animals' existence, while nature walks along quiet wooded

William Clark, NPS

Boy Scouts delight in Nature Center's terraqua.

trails depict wildlife in an undisturbed setting—an activity considered by some to be the ultimate form of park use.

The Rock Creek Nature Center in Washington, DC is one of several nature centers in the country. Of the 50,000 residents visiting the center each year, 60 percent are youngsters between the ages of four and fourteen. Therefore, special emphasis is placed on programs for this group, and exhibits and talks are geared to their educational level. Most of these youngsters reach the center through field trips and follow-up visits. Whether they are favorably impressed and influenced by the visit depends in large part on the thoroughness and genuine sincerity of our approach.

The information presented, if accepted, will probably serve as a foundation for future park use, and will likely determine the environmental conduct with which these individuals govern themselves at other park sites across the nation. Nature centers are unique and outstanding in their value as natural interpretive facilities, and are ideal places for youngsters and other individuals to gain a basic appreciation of park resources and values. We cannot overemphasize the importance of firsthand contact with nature, for nature study and appreciation are fundamental keys and vital factors in collectively and systematically conserving our natural areas.

Lurrie V. Pope is Supervisory Park Ranger, Rock Creek Nature Center in the National Park Service's National Capital Region.

Urban Forestry—Forestry of the Future

by Frederick J. Deneke and Larry E. Biles

USDA Forest Service

The USDA Forest Service helps cities develop urban forest management programs.

Why should foresters and the forestry profession become involved in urban forestry? At a recent urban forestry training session for field foresters, it was noted that one of the foresters jotted a note to himself that said, "And this is forestry?"

That surprised us. It made us realize how much we in urban forestry have failed in communicating the value of forestry in an urban setting to a professional colleague. We could understand the disinterest of a traditionally-trained forester working with the natural resources associated with transportation corridors, water corridors, municipal watersheds, parks and other open space areas. We couldn't, however, understand the lack of foresight by this individual into the far-reaching aspects of urban forestry.

The terms urban and forestry may present a contradiction to some, but they are a reality. A recent survey reveals over 94,000,000 acres of urban-suburban land in the United States. Over 25 percent of this land is classified as open space and, consequently, contains a variety of resources that have a marked impact on the quality of life in urban areas. The forestry profession, through urban foresters, has something to offer society in the wise use of these natural resources. More importantly, however, the forestry profession has a responsibility to several local, state and national concerns. We are all aware of the predictions of a timber shortage in the future, and of the role the small, non-industrial, private forest landowner must play in meeting projected timber demands. We are also aware of the issue surrounding the continual depletion of the commercial forest land base, the energy crisis, and the battle for a fair share of program budgets for natural resource management. Think about these facts:

1. 76 percent of America's population lives in urban areas.
2. 75 percent of the Congress has an urban constituency.
3. Over 50 percent of the non-industrial, private forest landowners live in an urban environment.

How is urban forestry, or forestry for that matter, related to these problems and statistics?

Urban Forestry Cooperation

In 1978, the Congress charged the U.S. Department of Agriculture's Forest Service with a basic responsibility of helping cities develop urban forest management programs. This responsibility is subsequently passed to the State Forestry Agencies in the form of Federal-State cooperative agreements.

Forestry leaders in Florida, Maryland, Oregon, Virginia and other states have sensed that they have a stake in land use issues at the urban-rural fringe. Each year, in excess of 1,000,000 acres of commercial forest land is lost to urbanization. Urban foresters are working closely with land use planners to channel development around the most productive forest lands. They are also helping to set aside green space for recreational opportunities, wood production, and fish and wildlife habitat. These same foresters are helping to find markets for timber cleared during development and to advise on erosion and sedimentation problems.

This service is expected to gain exceeding importance as a result of a report submitted by the President's Commission for a National Agenda for the '80's, released on December 31, 1980. This commission, in a very controversial decision, recommended that people be encouraged to migrate to the sunbelt states. If followed, this recommendation could have a major impact on the nation's wood basket. Urban forest managers at the county and city level can play a major role in minimizing the environmental and productionless impact while simultaneously assuring that adequate green space is set aside for urban dwellers. In addition, these foresters can promote and direct production management of some non-traditional forest land areas.

Tree Planting Along Public Thoroughfares

An urban forester in Georgia has long been advocating the planting of trees for commercial production along interstate rights-of-way highways and other public thoroughfares. His studies reveal that 36 acres are taken out of production for every mile of interstate highway. He estimates that at least nine acres, or 1/4 of this idle land could be planted to trees without violating DOT safety standards. Properly managed,

USDA Forest Service

Urban foresters are making a recognizable contribution to the urban dwellers' home and work place.

this land could yield a net return of over $300/mile/yr after the first rotation. Not only would this contribute to the nation's timber supply, but would also reduce the annual grooming cost now associated with interstate highway rights-of-way management. An urban forester in Cincinnati has found over 7,000 acres of land that could be planted to trees for commercial production within the city's boundaries. Surveys in other major cities would probably produce similar results.

Reaching Out to Urban Audience

Urban foresters in many states are realizing that their future, the entire forestry profession's future, and the future of natural resource management is in the hands of urban voters. Consequently, they are conducting aggressive urban forestry programs in their cities to reach that urban audience while simultaneously making a recognizable contribution to the urban dweller's home and work place.

Over five years ago, a meeting held by an urban forester for absentee landowners in St. Louis resulted in 88 attendees with a combined ownership of over 11,000 acres. This and other similar efforts by urban foresters in Missouri played a major role in the passage of a special sales tax mill levy which has benefited all of the state's natural resource programs. Conversely, the California legislature has mandated that a portion of the timber sales receipts from state-owned forests goes to an urban forestry fund which is available to cities for tree planting and maintenance.

Energy Source

Another item of national concern to urban foresters is energy. It has been estimated that urban wood waste (tree trimmings, waste paper, demolition wood, mill trimmings and other urban wood waste) could supply three percent of our nation's energy needs based on 1980 national energy consumption figures. This would be equivalent to 1.2 million barrels of oil per day. The proposed deregulation of natural gas should hasten waste wood recovery energy efforts in many of our cities.

Other estimates reveal that the proper use of trees and shrubs in a passive energy role in the home landscape could result in a 10-25 percent reduction in the energy required for home cooling. Based on 1980 figures, this would reduce total U.S. energy consumption by nearly one percent or about 400,000 barrels of oil per day. The interesting aspect of passive energy conservation is that existing buildings can be retrofitted with landscape plants without exorbitant cost. New homes, on the other hand, could be landscaped with emphasis on passive energy conservation with little or no additional cost or loss to aesthetic values.

Conclusion

As a profession, we need people-oriented urban foresters. We submit that urban forestry is the forestry of the future. In the words of Alvin Toffler, we like to call it the "third wave" of forestry. Production forestry will continue, but will increasingly be influenced by an urban public. Urban forestry can provide the linkage to a voting public long removed from the conservation ethic.

Frederick J. Deneke and Larry E. Biles are Urban Foresters with the USDA Forest Service. Deneke works in Washington, DC, and Biles in Atlanta, GA.

Urban Forestry—Tyler Arboretum Style

by David B. Williams

"To conserve and develop the arboretum facility as an outdoor living museum—for the continued benefit of the public as a whole—through the generous provision of scientific and educational opportunities, as well as passive recreation," is the stated purpose of the 700-acre John J. Tyler Arboretum located in Delaware County, Pennsylvania, less than fifteen miles from center-city Philadelphia.

Nearly 500 acres of the arboretum is in woodland, essentially the same as when the first owner, Thomas Minshall, received it as a land grant from William Penn in 1681. It remained in the possession of Thomas' descendants, the Minshalls, the Painters and the Tylers, until 1945 when it was bequeathed to the public as an arboretum.

The best remembered descendants of Thomas Minshall were the Painter brothers, Minshall and Jacob. These two Quaker farmers had little formal education but great acquired knowledge, particularly in the natural sciences. Between 1830 and 1875 the brothers planted nearly 1,000 trees and shrubs on the property, of which about 100 remain today. The Painter brothers had a keen interest in plants and trees which they collected and nurtured on their property with the intent to preserve them for future generations.

Considering that 38% of Pennsylvania's population, or approximately 4.8 million people, live in the greater Philadelphia area, the arboretum is quite popular and is utilized extensively. Many people from the surrounding urban and suburban areas find it an ideal place to get away from the urban setting and hike the arboretum's "wilderness" trails, examine the diverse ornamental plantings, and attend the many educational programs sponsored by the arboretum. The area provides an ideal setting for the urban resident to learn more about nature, natural resources, and the environment.

Tyler Aboretum staff

Although this hollow beech is valueless as timber, it is essential for wildlife, and quite valuable from an educational and aesthetic point of view.

Silviculture Education

In 1978 Robert Montgomery, the Director of Tyler Arboretum, felt there was a need for additional resource education, particularly in the science of silviculture, which is not well understood by the public. A portion of the arboretum called East Woods provided an ideal setting to demonstrate silvicultural practices.

It was proposed to the Board of Trustees that the East Woods tract be placed under a woodland management plan. "If the arboretum is to be an effective educational institution," it was argued, "it must develop programs and practices that demonstrate wise use and management of our natural resources, such as woodland." A managed forest would be educational in that it could be compared with unmanaged portions of the arboretum and also serve as a demonstration area for proper forest management. Management would also improve wildlife habitat, provide better diversity of tree species, thus making the area less susceptible to catastrophic

Tyler Arboretum staff

All log skidding was done with tracked machinery to minimize soil disturbance and keep damage to the remaining trees at a minimum.

insect or disease infestations, facilitate forest fire control efforts, and provide a needed research area. In addition, the sale of timber would provide some revenue to the arboretum.

The Board approved the proposal and began setting objectives. In managing the East Woods, the arboretum sought a plan that would integrate timber production, wildlife, water quality, recreation, and aesthetics. The forest resulting from this type of management would produce more and better quality timber than an unmanaged forest and would also provide essential wildlife habitat and woodland beauty, essentials for recreational use of the forest.

Forest Management Plan

Using the arboretum's objectives, a forest management plan was prepared by Urban Forester Ronald Langford, Pennsylvania's Department of Environmental Resources, Bureau of Forestry, covering 50 acres of the 90-acre East Woods tract. The remaining 40 acres were scheduled for future treatment.

The woodlands are typical of those found in that area of Pennsylvania, consisting of natural stands of mixed oak with some yellow poplar-oak associations. The condition of the woodland was excellent, as was the growing site. An inventory showed red oak, black oak, and yellow poplar to be the main species, with hickory, red maple, beech, black gum, scarlet, chestnut and white oak, and sassafras present in lesser numbers. The inventory found the area to be overstocked—too many trees per acre for optimum growth. The number of trees per acre was to be re-

Tyler Arboretum staff

All haul roads and log decks, such as this one, were seeded with grasses and legumes as soon as logging was completed.

duced to a more acceptable level through harvesting. Harvesting was to be selective in nature, removing some of the mature and defective trees so the remaining, better-quality trees had ample growing space and received adequate sunlight to maintain a fast rate of growth.

Tree quality on the entire tract was excellent. Many of the mature oak and poplar were of veneer quality, the highest and most valuable grade. There was no evidence of previous cutting in the stand, but there were indications of past forest fires. Many of the large beech are hollow as a result of these fires.

Although these beech are culls, and therefore valueless for timber, they are essential for wildlife and quite valuable from an educational and aesthetic point of view. Because the East Woods supports a variety of wildlife, including the white tailed deer and most of the smaller mammals and birds found in the area, the management plan called for other cuttings and specialized wildlife practices in addition to the thinning, to increase habitat diversity. A "no cutting zone" was also planned around a spring to ensure the water quality remained unimpaired.

Public Relations Efforts

With the Board of Trustees in concurrence and the forest management plan prepared, the task of selling forest management to the 700 arboretum members was begun. Because of the high public usage at Tyler and the urban nature of the surrounding area, it was imperative that the membership and the public be made aware of what was proposed, why it was being done, the benefits of forest management, and how it was going to be accomplished. To most of the people in the area, the cutting of even a single tree has far greater significance than it has where forests are more abundant.

The arboretum bulletin, *Tyler Topics*, was utilized to explain the management plan and the theory of silviculture to the members. In addition to the bulletin, it was decided to hold a series of lectures and workshops to involve the membership and the public in the decision making process, and to further public understanding of woodland management. The lectures and workshops were scheduled weekly during the month of October 1979.

The lectures covered the topics "Setting Objectives of Land Management," "Principles of Silviculture," "Wildlife Management," and "Discussion of Tyler Arboretum's East Woods Management Plan." Speakers included William S. Corlett, Pennsylvania Bureau of Forestry, Department of Environmental Resources; Richard Roth, U.S. Forest Service; Dr. Robert Shipman, Professor of Forest Ecology at The Pennsylvania State University; and the Arboretum staff.

A Saturday workshop was also held in the East Woods. Urban Forester Ronald Langford and Service Forester Cornelius Brown, both of the Bureau of Forestry, DER, conducted an on-the-ground "Woodland Management" class, demonstrating how a timber stand analysis and inventory is made, what is involved in the preparation of a forest

management plan, and a general discussion of woodland management principles. They also explained what was proposed for the East Woods and tried to have the audience visualize what the area would look like after the thinning. The lectures and workshop were well attended, and ample time was scheduled for discussion and answering questions. As a result of the publicity and public involvement, very few people objected to the harvesting operation.

Tyler Arboretum staff

Woodland management workshops were held to further public understanding of silviculture and the East Woods project.

Harvesting Operation

The next step was to employ a consulting forester to mark and sell the timber and to administer the operation. A contract was signed with the Robert H. Bommer, Jr., Inc. consulting firm from York, Pennsylvania, to do the job. Carl Geesaman, a forester with the firm, selected and marked a total of 337 trees containing 153,000 board feet to be cut for lumber and veneer, and he also marked 51 cull trees. Some of the cull trees were girdled and left standing, and at least three live cull trees per acre were left for wildlife and trees and nesting sites.

The timber was sold to Dave Bullock, a native of the Philadelphia area, who operates a logging company near Coudersport in northcentral Pennsylvania. Bullock was an excellent choice for the job. He had cut several other timber sales in sensitive urban areas, and had a record of doing exemplary work.

Because the area was to be used for demonstration purposes, it was necessary to remove the topwood. It was written into the timber sale contract that the tops were to be utilized for firewood. Most of the firewood was sold by the logger, but approximately 30 percent was left for the arboretum. The arboretum management offered this wood to its members at a reduced cost and provided good public relations in an area of high-priced fuelwood.

All skidding of logs was done with tracked machinery to minimize soil disturbance and keep damage to the remaining trees at a minimum. The skidding was done on skid trails and roads laid out by the forester, and all skid trails, roads and log loading areas were graded smooth and seeded with a mixture of grasses and legumes when logging was completed.

Public involvement did not stop when logging began. Tours were scheduled periodically, and groups could take a casual walk through the area seeing firsthand an active logging operation and woodland management. Logging was completed in March of 1980, but these walks continue today on the second Saturday of each month, with forums on the third Tuesday. These continuing functions keep the public updated on progress in the East Woods and serve to further public undertanding of forest management.

Conclusion

Bob Montgomery and the arboretum staff did an excellent public relations job by using their arboretum bulletin, scheduling the lectures and workshops, and having tours while the harvesting was in progress. The public knew what was going to happen and why, and they had the opportunity to provide input. Because of these efforts the East Woods of Tyler Arboretum is being managed, and the harvesting was conducted smoothly. Arboretum membership has actually risen since cutting began.

During the Arbor Day celebration on April 25, 1981, Tyler Arboretum became a certified member of the American Tree Farm System when the State Forester of Pennsylvania, Richard R. Thorpe, presented the green and white Tree Farm sign and certificate to Director Robert Montgomery. Tyler is the only arboretum that has been designated a member of the American Tree Farm System—and all this within a 20-minute drive of Independence Hall and the Liberty Bell.

David B. Williams is a Cooperative Forestry Assistant with the Forest Advisory Services, Pennsylvania Department of Environmental Resources.

Cost Effectiveness in Managing Urban Forests

by E.R.F.W. (Ted) Crossman, Philip A. Barker, and J. Alan Wagar

Cities can probably get a "bigger bang for the buck" in their street-tree programs. Interviews and discussions with a number of urban forestry workers in California, along with our own analyses, suggest that the costs of managing urban trees might be cut substantially without losing the benefits they provide. We are in the early stages of a research effort to analyze the cost effectiveness of urban forestry, especially street-tree management.

Our focus is on costs. Although the benefits of urban forests are difficult to quantify, people generally agree that urban trees confer both emotional and utilitarian benefits. The very term "shade-tree" reflects some of this. With the benefit side of the cost-benefit equation generally accepted, the challenge to managers is to provide these benefits at the lowest cost per tree.

Because trees, once established, normally live for many years, each decision in their management tends to commit the city to a stream of future costs. These costs may be higher or lower and need to be determined by procedures that permit immediate savings to be weighed against investment in better trees, management procedures, or equipment that will provide substantial savings through the years. Some of the factors to consider are (1) record keeping that permits costs of different species and procedures to be compared, (2) choice of species or cultivars which require minimum overall costs, and (3) management strategies or techniques that streamline operations and reduce costs.

USDA Forest Service

Many people are allergic to the pollen of this Glossy Privet's (Ligustrum Lucidum) flowers.

Record Keeping

If street tree management decisions are to be cost-effective, the manager must project the costs likely to result from implementation of each of the various possible choices (such as species). The basic requirement for forecasting costs and improving management decisions is a historical record of the dates when individual trees are planted, maintained, and removed, and the manpower expended in these activities.

We have found that few cities have such detailed records, particularly manpower inputs for each activity performed. Those that do keep records often cannot readily retrieve them. This may be true even for cities with computerized records, where the needed types of data outputs were not clearly envisioned at the time the records were started. Cities should, therefore, consider compiling a data base on the species, size, and location, and on manpower expended on each tree as work is performed, incrementally creating a cost-analysis record and inventory which eventually would embrace all trees under a city's jurisdiction. Such a data base is also likely to prove valuable in efficiently scheduling current activity and in responding to citizens' inquiries, legal claims, and so forth.

Because each city's experience is limited, planning data are often sought from other cities with experience relevant to a situation or problem novel to the enquirer. Mutual assistance would be facilitated if several cities in the same area were to keep their street-tree records in a format facilitating data interchange, as is done by fire departments using the Uniform Fire Incident Reporting Scheme (UFIRS).

USDA Forest Service

Once widely planted in California, the Camphor tree (Cinnanonum Camphora) has lost popularity for use along urban streets because of butt-swell at the trunk base which wrecks sidewalks and curbs.

Choice of Species or Cultivar

Perhaps no other decision has a greater impact on future tree management costs than the species or cultivar chosen for a given location. Some trees are relatively problem free, while others require excessive maintenance. Unfortunately, a cycle seems to have developed in which cities buy trees from the lowest bidder, thereby encouraging nurseries to emphasize species that grow quickly to saleable size. But such vigorous, fast-growing species are precisely the ones that often create costly problems. The fast-growing sweetgum *(Liquidambar styraciflua)* is an example. In the San Francisco Bay area we found it to be among the five most commonly planted species in 17 of 18 cities studied. We also found that among ten commonly planted species, sweetgum had the highest incidence of damaging sidewalks. More specifically, of a sample of 114 sweetgums in Oakland, California, 84 (74%) caused serious damage to the adjacent sidewalks by the time they were 35 years old (Table 1). If damaged sidewalks are not repaired, citizens, especially the elderly, may trip and be injured, and successfully sue the city for amounts that often dwarf the savings made by not doing the repairs. On the other hand, sweetgum requires only a modest amount of pruning compared with many species. Obviously, the liabilities of a tree need to be weighed against its assets.

USDA Forest Service

The Chinese Elm (Ulmus Parvifolia) requires an excessive amount of pruning to keep drooping branches and limbs clear of vehicles and pedestrians.

Table 1. Percentage of 114 sweetgum trees by age classes when repair of adjacent sidewalks was required.

	Age class (years)						
	0-5	6-10	11-15	16-20	21-30	31-35	Total
Percentage of trees	0	3	12	7	31	21	74

USDA Forest Service

Because it requires little maintenance, this Japanese Maple (Acer Palmatum) is a highly desirable tree for urban areas.

Since every tree eventually needs to be removed, removal costs also comprise an important element of a city's tree budget. Trees that grow to the largest sizes understandably cost the most to remove. And the fastest growing trees are likely to require removal sooner than slower growing species.

Average annual costs might well be reduced by planting trees known to have low overall costs, even though their initial cost is several times that of other species. *Determining the average annual cost differentials among an array of tree species is a major goal of this research.*

MANAGEMENT STRATEGIES

Scheduling Work

Costs also depend on the manner in which maintenance work is performed. In some cities, each block or other grouping of trees is worked on at intervals of 3 or more years. Other cities have abandoned scheduled maintenance because of fiscal constraints and only respond to crises or citizen requests. Crisis maintenance may require less total time, even though the travel time per tree may be substantial. This would be especially true if the trees had been previously maintained on schedule. Over time, however, maintenance requirements may accumulate until requests and travel time overwhelm available personnel and equipment.

Special Procedures

Special procedures might reduce some management costs. For example, tree removal is simplified if aerial buckets are available so less climbing is required of crew members. Use of a stump cutter simplifies stump removal as compared with digging stumps by hand or backhoe. To control roots, plastic planter boxes and barriers are now commercially available and are being tested by some cities and, along with other root-control procedures, in one of our studies. Utility companies have been using growth retardants for several years to reduce the need for pruning, and some cities are now testing them.

As another example, two-storied stands might be used in some situations. If analysis of records shows maintenance costs for some species to rise substantially with age, removing trees just before they begin developing costly problems might reduce maintenance expenditures. One approach would be to plant young trees between older specimens some years ahead of the time the older are to be removed. In the intervening years the young trees would grow to useful size, assuring continuous benefits. A second approach, suited especially to new plantings, would be to plant slow-growing but relatively trouble-free trees in between a "nurse crop" of trees that grow quickly to effective size. The faster growing trees would then be removed as they reached the size and age associated with rising maintenance costs. By then, the slower growing trees would be big enough to provide many years of benefits at minimal cost.

Although our analyses of urban tree maintenance costs are just beginning, we are far enough along to believe we will be able to provide urban tree managers with procedures for judging the long-term cost consequences of their tree management decisions.

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National Urban Forestry Conference

by Richard Pardo

USDA Forest Service

Trees and vegetation make the street a more pleasant place to live, enhancing both property values and human values.

If you are in any way involved with the care, maintenance and use of trees in city planning, urban parks and recreation, suburban development, open space protection or civic improvement, or if you would just like to see your own living and working space made more liveable, there is a meeting coming up in October 1982 in Cincinnati, Ohio, that you should plan to attend.

It's the Second National Conference on Urban Forestry, scheduled for three days in the downtown Cincinnati Convention Center and Stouffer's Towers Hotel. It will be sponsored by the American Forestry Association, the U.S. Forest Service, the USDA Extension Service and the Ohio Forestry Association. The dates are October 10-14, 1982.

The First Urban Forestry Conference was held in Washington, DC in 1978, and if you were among the 450 foresters, planners, researchers, city officials and involved citizens that attended, you know how much valuable information you were able to glean from the many speakers and exhibitors who were present.

The first conference was designed to help define urban forestry and to build a cohesive urban forestry movement from among the many people across the country who were working with trees and forestlands in the urban environment. It successfully established a

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Trees and recreation go together, as this jogger knows.

common bond among the participants, who came away from the meeting more certain of their direction and more committed to making things happen in urban forestry.

The second conference will be twice as large, three times as informative, and ten times as useful to you as the first one was. A great deal has been happening in the field of urban forestry since 1978, and the people who have been most active will be there to tell their stories, swap ideas, and generally pool their know-how to generate even greater progress beyond 1982. However, the conference is not only for urban forestry practitioners. It is also for the city official who wants to know how trees can help solve his or her problems and for the citizen activitist and the leaders in the business community who traditionally provide the political, financial and management muscle to make improvements happen.

The theme of the conference will be: "Urban Forestry for More Liveable Cities: Making it Happen." The conference will focus on presentations by people who are already making it happen in urban forestry, from coast-to-coast. Among the speakers will be: Fred Deneke, U.S. Forest Service and Gene Gray, USDA Extension Service; Fred Bartenstein, Assistant City Manager of Dayton, Ohio; John Rosenow of the Arbor Day Foundation; Steve Sandfort,

USDA Forest Service

These youngsters are helping to beautify their school yard themselves as part of a tree planting program.

Cincinnati Urban Forester; James Kielbaso of the University of Michigan; Gary Moll of the Maryland Forest Service; John Dwyer, U.S. Forest Service, Chicago; John Gray of the Pinchot Institute; and a host of other city forest managers, planners, officials and civic leaders.

Conference Schedule

More than 75 success stories from the "city edge" will describe how sound planning and hard work can turn developers from destroyers to cooperators; how communities are planning ahead to provide for both green space and growth space, and how people from all sectors can be brought together to support tree programs.

Fund-raising will be a major topic: How do you raise funds from the public and private sectors, and if you don't have any funds, how do you put a program together?

Specific topics slated for presentation include;

- The vision and reality of urban forestry: What can urban forestry be, and how do we make today's vision tomorrow's reality?
- Identifying the needs of the cities and ways that urban forestry can meet those needs.

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Converting tree residues to firewood has meant added revenues to some cities.

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The urban forest includes more than just trees.

- Success stories from the cities, and from the city edges, where lands transformation is being shaped, for better or worse.
- Using public involvement and creating grass-roots neighborhood support.
- Gaining media support.
- Building coalitions with other urban interest groups for political clout.
- Using urban forestry to conserve energy and improve physical surroundings.
- Recreation and wildlife opportunities in an urban setting.
- Economic productivity from urban trees and forests.
- Using the urban forest as a conservation education device.
- Techniques of legislating for urban forestry at the federal, state and local level.
- Liability, litigation and other legal ramifications of urban forestry programming.
- Fitting urban forestry into the organizational chart.
- Funding urban forestry programs from grants and revenues.
- Where to go for private funding, and how to get it.
- Funding any which way you can.
- Research, information and training sources, public and private.

In short, if you are an urban official, responsible for trees and open-space planning as an elected city official, a land developer, attorney, city forester, parks director, civic leader or concerned citizen, the program is designed to meet your needs.

Conference Site

Cincinnati itself is an outstanding site for the meeting. It was here that the first American Forest Congress was held in 1882, and ceremonies on the opening day of the conference will recreate the historic tree planting in Eden Park in which 35,000 people turned out to initiate a President's grove of trees, give a national boost to a new idea called Arbor Day, and focus national attention on the need to create an awareness of forest conservation.

One hundred years later, this event will mark the renewal of national awareness of the values of tree and forest management in the metropolitan area where most of our people live, work, and spend an increasing amount of leisure time.

Conclusion

If you'd like to receive further information on the program as it develops, or if you know of any city officials, interested citizens, or civic leaders who should receive conference information, we'd like to hear from you. Exhibitors are also invited, and organizations wishing to join as conference cooperators also are invited to write. Address all correspondence and questions to: Richard Pardo, Programs Director, The American Forestry Association, 1319 18th Street, N.W., Washington, DC 20036.

Once again, those dates are October 10-14, 1982, in Cincinnati, Ohio. We'll look forward to seeing you there.

Richard Pardo is Director of Programs and Legislation for the American Forestry Association.

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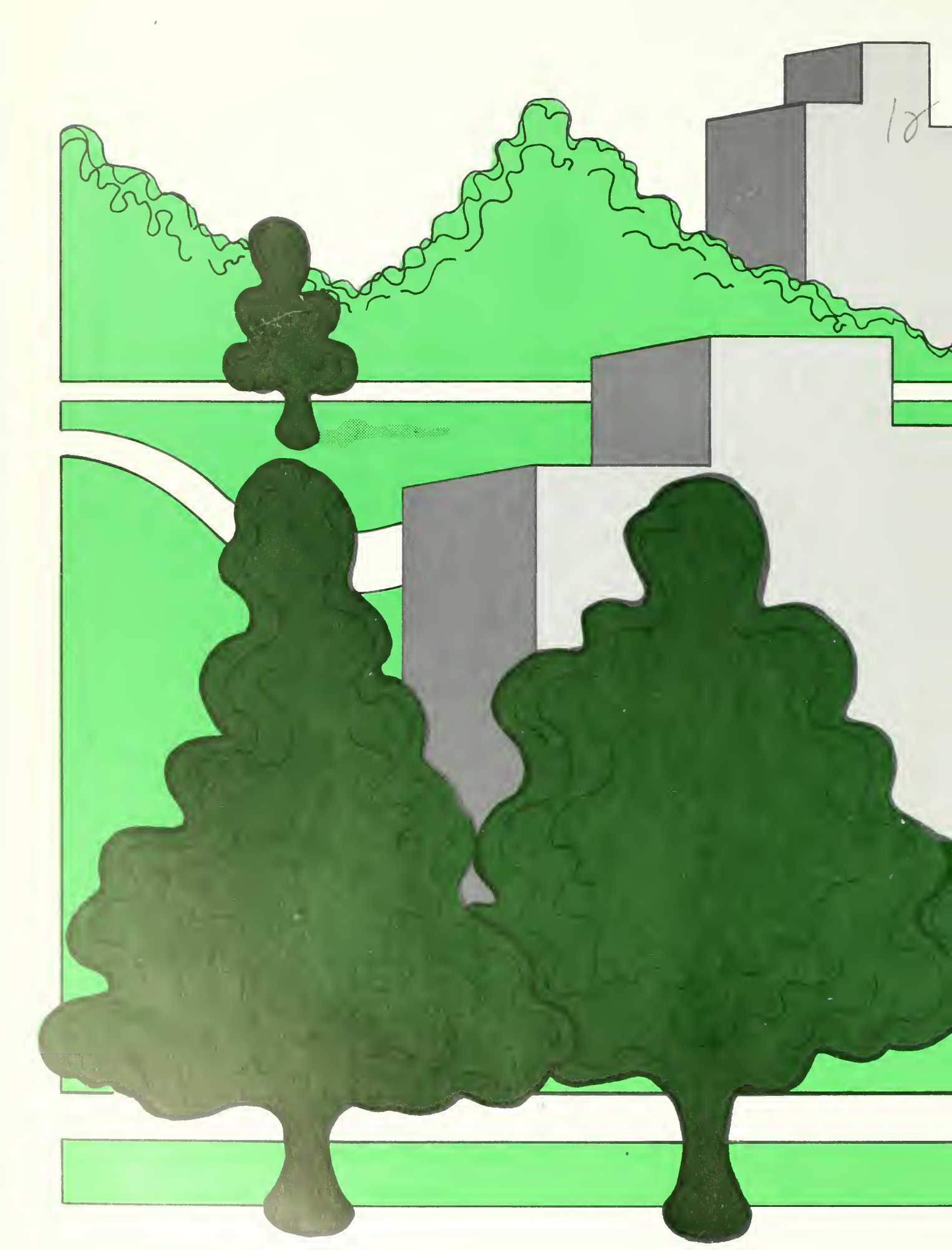

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